THE
METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Institute of Metals Meets in New York

A Report of the Annual New York Meeting Held February 20-21, 1929

By H. M. ST. JOHN
Chief Metallurgist, Detroit Lubricator Company, Detroit, Mich.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers held its annual meeting in conjunction with the Institute during the week of February 18th. In addition to taking part in the general sessions of the A.I.M.M.E. the Metals Division program consisted of the annual dinner and four technical sessions for the reading and discussion of papers on the non-ferrous metals and their alloys.

The annual dinner of the Institute took place at the Savoy-Plaza Hotel, New York City, on Tuesday evening, February 19, with several hundred members present. The speaker of the evening, A. J. Wadhams, manager of development and research of the International Nickel Company, gave a fine talk which covered the history of the nickel industry, with particular reference to his company's activities in recent years. Mr. Wadhams had a paper prepared, but seldom referred to it, and his excellent discussion of the progress of this large field of metallurgy was made even more enjoyable by many wise and humorous digressions and remarks, all of which were immensely appreciated by the audience.

After the dinner there was a short business meeting of the Institute, at which the nominating committee presented for election as officers the same list as have been in office the past year: Chairman, S. Skowronski; vice-chairman, Dr. Zay Jeffries; secretary-treasurer, W. M. Corse. These were elected by unanimous vote, as were the following members of the Executive Committee: R. J. Freeman, R. S. Archer, Dr. P. D. Merica, Sam Tour, E. C. Bain, F. L. Wolf, G. E. Johnson, T. S. Fuller, H. M. Williams and W. A. Scheuch. The following were elected to the nominating committee: F. L. Wolf, Sam Tour, N. K. B. Patch, H. M. St. John and W. R. Webster, chairman.

There were short reports of several committee chairmen and some announcements by the chairman. It was announced that F. T. Taylor, vice-president of the Hanson-Van Winkle-Munning Company, Matawan, N. J., would deliver the lecture at the next meeting of the Institute to be held in connection with the meeting of the American Society for Steel Treating, in the Fall of 1929.

REPORT OF THE SECRETARY OF THE INSTITUTE OF METALS DIVISION

The Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers held two successful meetings during 1928. At the annual meeting in New York in February five sessions were held and thirty papers were presented. The features of the meeting were two symposiums, one on "Precious Metals" and the other on "Secondary Metals." The fall meeting was a joint one with the American Society for Steel Treating, and was held in Philadelphia in October. Twelve papers were presented at the three sessions.

Dr. C. H. Mathewson of Yale University delivered the annual lecture at the February meeting. The speakers at the two dinners were Messrs. W. H. Bassett and F. M. Becket, both of the addresses appearing in "Mining and Metallurgy."

The proceedings of the Institute of Metals Division for 1928 carried 37 papers with a total of 836 pages, and is a noteworthy contribution to the non-ferrous metallurgy literature.

The Membership Committee reports 292 new members secured for the Division since the February meeting in 1928. These members were secured from the following sources:

New members obtained from A.I.M.M.E. membership list	205
New members obtained by canvassing "Mining and Metallurgy"	42
New members obtained from various I.M.D. members	45
Total	292

Total membership of the Division on February 11th was 1,260.

At the May meeting of the Institute of Metals of Great Britain the secretary of the American Institute of Metals Division personally extended to that body the invitation of President George Otis Smith to meet in the United States in 1932, which invitation was formally accepted. A committee on arrangements for taking care of this joint meeting has been appointed by Mr. Skowronski, chairman.

The financial condition remains unchanged. Interest on invested funds is used to defray the expenses of the annual lecture, and the current expense items for the year, of approximately $250 are covered by funds from the treasury of the Main Institute.

The Division is again honored by the James Douglas Medal Committee in the award of the 1929 medal to the past chairman, Dr. Paul D. Merica of the International Nickel Company.

At the dinner, the speaker of the evening, A. J. Wadhams of the International Nickel Company, spoke on the subject, "Nickel and its Alloys." Mr. Wadhams traced the historical development of nickel from earliest times, when it was present as an important constituent in weapons made from meteoric iron, down to its present widespread use in many ferrous and non-ferrous alloys. During the World War ninety percent of the nickel production was absorbed in the manufacture of armament. Since that time, as the result of exhaustive research and intensive industrial development, the output of this important metal has been diverted to a multitude of peaceful applications.

Officers of the Institute of Metals Division

ZAY JEFFRIES,
Vice-Chairman

S. SKOWRONSKI,
Chairman

W. M. CORSE,
Secretary-Treasurer

Abstracts of Papers

DISPERSION HARDENING IN COPPER AND SILVER BASE ALLOYS

By J. L. Gregg

The author described a series of experiments in which rolled or forged specimens of copper alloys containing various percentages of silicon, beryllium, nickel, cobalt, manganese, magnesium, iron, zinc, aluminum and tin, in a large number of combinations, were quenched in water from 1600°F (871°C) and then aged at lower temperatures. The Rockwell hardness of the specimens as quenched, compared with their hardness after aging, was taken as a measure of their dispersion hardening.

THE HEAT TREATMENT AND MECHANICAL PROPERTIES OF SOME COPPER-ZINC AND COPPER-TIN ALLOYS CONTAINING NICKEL AND SILICON

By W. C. Ellis and E. E. Schumacker

Three alpha brasses containing three percent of nickel plus silicon in the proportion necessary to form nickel silicide were described. It was found that a suitable heat treatment can be employed to vary the mechanical properties of copper-zinc alloys containing nickel and silicon and that the properties developed in this manner are such as to make these alloys industrially useful.

SOME OBSERVATIONS IN HEAT TREATMENT OF MUNTZ METAL

By L. Russell Van Wert, Pittsburgh, Pa.

When a brass of the Muntz metal type is cold worked after quenching within the beta field it is partly broken down, with precipitation of the alpha solution into the cleavage planes of the beta grains. This process has been studied and is abundantly illustrated with microphotographs. It was also noted that on reheating to the beta range the beta grains of a slowly-cooled alloy exhibit no growth abnormality while those of a quenched alloy do. This is illustrated with figures and the explanation is offered that the somewhat strained condition of the beta phase in the quenched alloy induces an excessive grain growth.

HIGH-STRENGTH BRASSES

By O. W. Ellis, East Pittsburgh, Pa.

In this paper an attempt is made to prove that the substitution of aluminum, iron, and manganese for zinc in a complex brass is quantitative in its effect on the mechanical properties of the alloy in the chill-cast state. Hence, given the analysis of an alloy, its mechanical condition in the chill-cast state can be determined by reference to curves showing the relationship between the "metal" content and the tensile properties of the material. If we accept the view that all three elements—aluminum, iron, and manganese—are of real value in these complex alloys, it seems logical to consider the high-strength brasses as aluminum brasses to which small proportions of iron and manganese are added, the former for the purpose of increasing the ductility without reducing the strength, the latter for the purpose of increasing the strength without reducing the ductility.

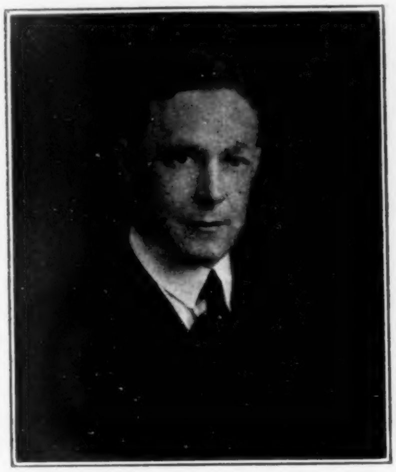
EFFECT OF ARSENIC ON DISPERSION-HARDENABLE LEAD-ANTIMONY ALLOYS

By K. S. Seljesater

Arsenic has no solid solubility in lead and is known to form a continuous series of solid solutions with antimony. Therefore, immediately after annealing and quenching, the

antimony is in solid solution in the lead, and there is a certain amount of eutectic between the lead-antimony solid solution and arsenic. After quenching, the lead-antimony solid solution is supersaturated (the same as if arsenic were not present) and minute crystals of antimony separate. Since arsenic is soluble in antimony, some of the arsenic present will be concentrated in the surface layer of the minute antimony particles, which will then possess surface conditions different from those of pure antimony particles. The condition of the alloy at this stage is analogous to a suspension in a liquid which has been partly stabilized by a third constituent. Agglomeration and precipitation will occur, but at a much slower rate than if the third constituent were not present. Arsenic, therefore, is to be considered as a retardant for the agglomeration of minute antimony particles in the lead matrix. The length of the stabilization time decreases at elevated temperatures. The offered explanation is in agreement with the fact that the increase in hardness is practically independent of the percentage of arsenic within limits investigated. The addition of a third constituent insoluble in the solvent and forming a continuous series of solid solutions with the solute, might be of advantage to other kinds of age-hardenable binary alloys.

SAM TOUR,
Nominating Committee



H. M. WILLIAMS,
Executive Committee

F. L. WOLF,
Nominating Committee

INCIPIENT SHRINKAGE IN SOME NON-FERROUS ALLOYS

By J. W. Bolton and S. A. Weigand.

This paper aroused a great deal of interest and discussion because it brought modern metallurgical methods to bear on a brass-foundry problem which has for many years been the subject of much discussion without much basis of exact experimental evidence. The authors pointed out that the traditional belief as to the responsibility of oxygen and oxides for most cases of unsoundness in foundry brass and bronze is probably in error. As a result of experiments, both in the foundry and in the laboratory, they have reached the following conclusion::

"Internal porosity, commonly called oxidation, usually is traceable to general incipient shrinkage, which is very pronounced in metals melted under reducing atmospheres. It may be minimized by running a neutral atmosphere (by gas analysis, not by eye), by proper gating, and reasonable pouring temperatures."

The authors further attributed the unsoundness of metal melted in a reducing atmosphere to the direct action of carbon monoxide, either by absorption of the gas and later rejection during solidification, or possibly through the agency of secondary reactions of unknown character.

In discussion, W. F. Graham indicated that the most logical explanation of the influence of carbon monoxide might be an overreduction of the bronze, somewhat analogous to the overpoling of copper. L. W. Spring described an experience in which unsoundness of this character was definitely traced to the presence of about 0.04 percent of silicon in the bronze. H. M. St. John questioned the validity of the authors' conclusion that carbon monoxide is directly responsible for the difficulty, pointing out that hundreds of thousands of tons of brass and bronze have been melted in the predominatingly carbon monoxide atmosphere of the electric arc furnace with entirely satisfactory results. In his opinion, the trouble is most probably due to silicon which, if present, is unaffected by a carbon monoxide atmosphere but is oxidized and rendered harmless by an oxidizing atmosphere.

The paper was also discussed by M. G. Corson and Mr. Beck.

In summing up, Mr. Bolton stated that he had been unable to find more than traces of silicon in his unsound samples and also unable to duplicate the condition by introducing silicon in the melting of sound metal. The subject is one which, it is hoped, will be more fully treated in the proposed symposium on the effect of furnace atmosphere in the melting of metals, planned for the February, 1930, meeting.

A METALLOGRAPHIC STUDY OF TUNGSTEN CARBIDE ALLOYS

By J. L. Gregg and C. W. Kuttner.

This paper gives the results of an investigation of the structure of five of the tungsten-carbon alloys by means of microscopic and X-ray methods, the samples studied being small tools or wire-drawing dies. After a general discussion of the constituents of tungsten-carbon alloys, the preparation of the samples is decribed, and the structures found are shown.

The growing importance of these alloys in the manufacture of high-speed tools has aroused a great deal of interest in their structure. A method of determining their constitution by the use of selective etching reagents was described. Five commercial tungsten carbide alloys were studied by means of X-ray diffraction patterns and by microscopic examination. Four of them were found to contain a mixture of W 2 C with W C while the fifth contained W C only.

GASES IN A SAMPLE OF OVERPOLED FIRE-REFINED COPPER

By O. W. Ellis.

A sample of experimentally overpoled copper was analyzed quantitatively for the gases present. These amounted to 8 percent by volume of the copper and consisted of approximately 85 percent carbon dioxide and 15 percent water. Nitrogen, oxygen, carbon monoxide and hydrogen were absent.

EQUILIBRIUM RELATIONS IN ALUMINUM-MAGNESIUM ALLOYS OF HIGH PURITY

By E. H. Dix, Jr., and F. Keller.

Since commercial aluminum contains sufficient silicon to form some magnesium silicide when magnesium is alloyed with the aluminum it was the object of this investigation to determine the age-hardening effect of magnesium when alloyed with aluminum of high purity, free from silicon. A number of diagrams and photomicrographs were used to illustrate the results.

SOME PRACTICAL ASPECTS OF CREEP IN ZINC

By W. M. Pierce and E. A. Anderson.

It describes service and laboratory tests, some of which extended over a period of more than two years, to determine safe stress values for use in designing corrugated sheet-zinc roofs under various loading conditions.

Both sessions Thursday were devoted to a symposium on corrosion, under the chairmanship of H. A. Bedworth in the morning and T. S. Fuller in the afternoon. The papers given were as follows:

CORROSION OF METALS AS AFFECTED BY STRESS, TIME, AND NUMBER OF CYCLES

By D. J. McAdams, Jr.

It was shown that even slight corrosion simultaneous with fatigue may cause failure at stresses far below the ordinary endurance limit and that, for most metals, severe corrosion prior to fatigue is much less damaging than even slight corrosion simultaneous with fatigue. A number of metals, mostly ferrous with non-ferrous additions—such as nickel and chromium—were studied and the interrelationship of corrosion-stress, time, frequency of cycles, and fatigue limit illustrated by graphs. In discussion, F. N. Speller asked whether it would not be possible for the author to draw more definite and tangible conclusions from the mass of data and graphs presented, to which Dr. McAdam replied that the only conclusions which could be drawn at this time were given as clearly as possible by the graphs themselves.

SOME ASPECTS OF CORROSION FATIGUE

By T. S. Fuller.

Results of preliminary experiments were described, separating, so far as possible, the effect of hydrogen absorption on the physical properties of the corroded metal from the effect of corrosion pitting. It was concluded that absorbed hydrogen is a factor in the loss of fatigue resistance suffered by ferrous materials after certain types of corrosion. Corrosion by tap water causes a loss of strength which seems not to be influenced by hydrogen absorption. Professor Moore, in written discussion, and Dr. McAdam both questioned whether the author's conclusions were justified since the method of testing fatigue resistance was not of the standard character which they believed necessary in order to get a trustworthy comparison.

CORROSION OF TIN AND ITS ALLOYS

By C. L. Mantell.

This paper constituted a very complete discussion of tin, and a review of its literature, with reference to its chemical properties and resistance to various types of corrosion. In discussion, Mr. Walton Smith pointed out that one statement in the paper, affirming the resistance of tin to corrosion by potassium nitrate must be in error since potassium nitrate is used to dissolve tin in one of the processes for reclaiming tin from tin plate.

CORROSION OF METALS IN THE LEHIGH VALLEY

By C. E. Reinhard.

A series of experiments in which aluminum, ascoloy, copper, copper steel, galvanized iron and zinc were exposed to atmospheric conditions at various points in the Lehigh Valley was described. The test racks were exposed in several towns and rural locations, chosen in such a way as to encounter all of the various types of atmosphere likely to be found in this region. The specimens were inspected and weighed monthly after loose products of corrosion had been brushed off. By this method a pronounced gain in weight would be as indicative of corrosive action as would a loss of weight. The tabulated results listed the metals under test by symbol only and did not give a key to the symbols. Although it was explained by the author that the purpose of this was to avoid discussion as to the relative merits of the different metals until such time as the tests would be complete, his procedure was rather severely criticized in the discussion. The author's most important conclusion was that the same metal reacted quite differently to atmospheric conditions at different locations in a limited geographical area. N. B. Pilling, in discussion, pointed out the difficulty in getting quantitative results by any method which involves weighing the test specimen. Mr. Finkeldey stated that over a sufficiently long period of time, a loss-of-weight, determination will give reliable quantitative results, while for a shorter period only qualitative conclusions can properly be drawn; these may better be based on a visual inspection rather than on a loss or gain in weight.

THE INHIBITION OF THE CORROSION OF ALUMINUM BY SOAPS

By H. D. Churchill.

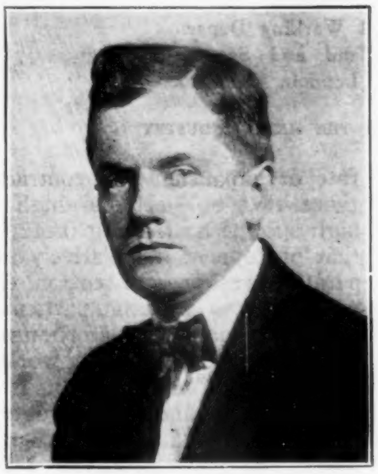
The author pointed out that, for economic reasons, metals must sometimes be selected for specific uses in spite of the fact that these uses may involve a corrosive condition which they are not well adapted to resist. One such case is the use of aluminum for collapsible tubes to contain shaving creams and other mildly alkaline cosmetics. By experiment it was found that 0.20 percent of sodium silicate added to a shaving cream would protect the aluminum from attack, possibly by the formation of a thin film on the metal or possibly because colloidal silica may have the property of rendering the alkali inactive. F. N. Speller called attention to the fact that the influence of sodium silicate in inhibiting the corrosion of iron is well known.

CORRELATION OF LABORATORY CORROSION TESTS WITH SERVICE: WEATHER-EXPOSURE TESTS OF SHEET DURALUMIN

By H. S. Rawdon.

A comparison was made between accelerated corrosion tests previously carried out in the laboratory and results of atmospheric corrosion tests now being made with the same materials. A very close agreement has so far been found, indicating the suitability of the laboratory test methods developed by the Bureau of Standards for the corrosion testing of duralumin. Change in tensile properties was found to be the best method of determining the degree of corrosion, the effect of intergranular corrosion being much more marked than the effect of surface pitting. The embrittlement of duralumin in service could be definitely ascribed to corrosion in most cases, this effect being

much more pronounced in marine atmospheres and tropical climates. Small variations in the composition of the duralumin had little effect on corrosion. Variations in quenching rate and aging treatment have a pronounced effect on the susceptibility to corrosion. Hot water or hot oil should not be used for quenching nor should accelerated aging be employed if the duralumin must withstand severe climatic conditions. With correct heat treatment, cold working the metal did not greatly affect its corrosion susceptibility. As a rule, protective coatings were not permanent enough to be very useful, although a coating of pure aluminum was found to be quite dependable. Experiments are under way to determine the effect of stress existing simultaneously with the corrosive attack.



P. D. MERICA
Executive Committee

In discussion, E. H. Dix, Jr., stated his agreement with the method of determining degree of corrosion by testing the mechanical properties of the corroded metal. The intergranular corrosion is the more serious form and may be caused by the formation of any intergranular precipitate. In some cases copper may be responsible for such a precipitate but silicon and zinc are more serious sources of trouble. Mr. Dix said that anodic coatings, while not in themselves very effective protection, formed a good base for paint. Pure aluminum offers effective protection, not merely by covering the duralumin, but also by electrolytic potential after the covering has been penetrated. In this way the exposed duralumin in the cut edge of a thin sheet is protected so long as any of the pure aluminum remains in its neighborhood. This applies also to uncovered duralumin rivets used with aluminum-clad duralumin sheet.

RESISTANCE OF COPPER-SILICON-MANGANESE ALLOYS TO CORROSION BY ACIDS

By H. A. Bedworth.

Hard-drawn and annealed wires of alloys of this character, containing up to 4.01 percent silicon and 1.21 percent manganese were tested by the method of alternate immersion in both cold dilute hydrochloric acid and dilute sulphuric acid at 60°C. Relative corrosion was determined by measuring loss in weight, tensile strength and elongation. It was found that increasing percentages of silicon and manganese, up to 3 and 1 percent respectively, greatly increased the corrosion resistance of the alloys to both acids. Further additions made little difference. At low percentages of silicon there was little difference between the hard drawn and the annealed wires; with increasing silicon the annealed wires showed much greater resistance to corrosion than did the hard-drawn wires.

In discussion, D. E. Ackerman questioned the value of results obtained by the method of alternate immersion unless great care was taken to control air currents, humidity of the atmosphere, purity of the air, etc. The presence of SO_2, H_2S or NH_3, as commonly found in the neighborhood of a chemical laboratory, might seriously influence the results. C. G. Fink expressed the opinion that these variables are not difficult to control or eliminate and that the method described has many points of advantage.

QUANTITATIVE MEASUREMENT OF CORROSION OF METALS IN WATER AND SALT SOLUTIONS

By G. D. Bengough, J. M. Stuart and A. R. Lee.

This paper was read by Dr. Ulick R. Evans of Cambridge University, England. It discussed the test conditions required for accurate corrosion experiments, with particular reference to the presence and condition of oxygen. Experiments were described illustrating the method of determining the degree of corrosion by measuring the absorption of oxygen.

RESISTANCE OF IRON-NICKEL-CHROMIUM ALLOYS TO CORROSION BY ACIDS

By N. B. Pilling and D. E. Ackerman.

The solubilities of alloys ranging from 0 to 100 percent nickel and 0 to 30 percent chromium in aerated acid solutions and in solutions containing sulphurous acids were studied. It was found that in non-oxidizing, hydrogen-discharging acids, alloys containing less than about 13 percent nickel suffered increasing solubility with increasing chromium and decreasing solubility with increasing nickel. With more than 13 percent nickel, the alloys corroded at a constant rate independent of iron, nickel or chromium content. In nitric acid and in unaerated sulphurous acid, the chromium content was of chief importance. The action of sulphurous acid was greatly influenced by the presence of small amounts of impurities in acid.

Dr. Evans inquired whether corrosion was general or localized and whether a condition of intermittent, or rhythmic, passivity was observed. Mr. Pilling replied that the corrosion was general. Mr. Ackerman stated that intermittent passivity was strikingly observed in the case of the nickel-iron alloys.

SOME NEW DEVELOPMENTS IN ACID-RESISTANT ALLOYS

By B. E. Field.

Alloys of nickel iron and molybdenum were described with especial reference to their resistance to hydrochloric and sulphuric acids. Another series of alloys, containing nickel, silicon, aluminum and copper, were found to have useful properties.

PRACTICAL APPLICATION OF CORROSION TESTS: RESISTANCE OF NICKEL AND MONEL METAL TO CORROSION BY MILK

By R. J. McKay, O. B. J. Frazer and H. E. Searle.

In the laboratory it was determined experimentally that, although minute quantities of nickel are dissolved by sweet milk, sour milk or buttermilk, this action is much below any point which would have an injurious effect on the products. Experiments in the field demonstrated that pure nickel is a suitable material for the construction of equipment to be used in the processing and handling of milk and most milk products.

ANNUAL INSTITUTE LECTURE

At the close of the Thursday afternoon session the annual Institute of Metals lecture was given by Dr. Ulick R. Evans of Cambridge University, England. His subject was "The Passivity of Metals and its Relation to the Problems of Corrosion." Dr. Evans gave a most able and interesting exposition of the oxide-film theory of passivity, supported by the results of a research which has been carried on under his direction at Cambridge. A number of specimens obtained during the progress of this work added greatly to the impressiveness of the conclusions reached. It is Dr. Evans' contention that during corrosion of iron and steel by water and air, oxygen is present, not in the areas where corrosion is actually taking place but at cathodic areas and that the resulting action on the metal is largely electrolytic.

Methods of Joining Aluminum and Its Alloys

Fluxes—Welding Materials—Preparation of the Metal—Execution of the Weld—Electrical Welding—Cast Welding—Riveting Aluminum—Part 2*

By A. EYLES

Foreman Sheet Metal Working Department, London, Midland and Scottish Railway Company, London, England.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

The modern method of autogenous welding provides a means of making permanent joints and repairs on aluminum and aluminum alloy products that were impossible some years ago. In fact, the process has so strongly demonstrated its utility that it is now recognized in the automotive and general engineering industries as the most reliable method of obtaining permanent and homogenous welds in such materials. Autogenous welding of aluminum suffered unnecessarily from secrecy about twenty years ago. Fortunately, there is little in the process that is kept secret today, although it requires skill and training, together with knowledge, how to apply and to design and prepare the work, as well as to make the welds. But when the technique of welding aluminum has been thoroughly mastered, aluminum is one of the most readily weldable of all metals. Until the method of jointing by autogenous

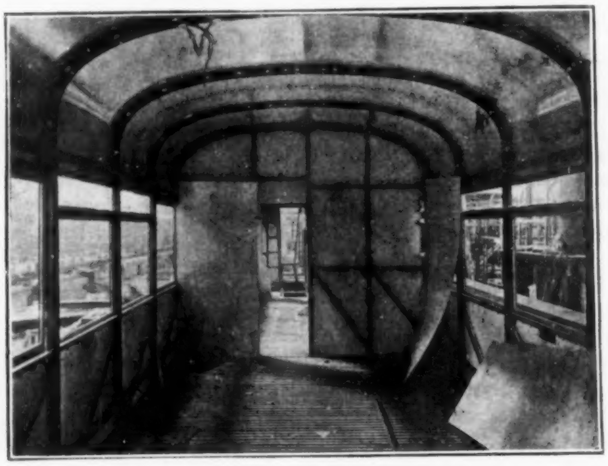


Fig. 1—Section of Railroad Passenger Car in Construction, Showing Aluminum Panels and Roofing

welding was perfected, the use of aluminum, especially in the assembly of structures, and the fabrication of sheet aluminum products was more or less restricted to those cases in which jointing was either unnecessary or of no great importance; but autogenous welding with the oxyhydrogen and oxyacetylene flame has been taken advantage of in the automotive and general engineering industries to an extensive degree, and as a result aluminum and aluminum alloys have not only supplanted other metals, but also various other materials in many branches of modern industry.

Autogenous welding of aluminum joints obviously makes a much stronger and more intimate union than soft soldering, there being no interposition of any heterogeneous metal. The special difficulties in welding aluminum are: the rapid oxidation of the metal; its high rate of expansion and contraction, being approximately twice that of steel; its high thermal conductivity; its high specific heat, being 0.212, which is more than twice that of copper; its relatively low fusion point; its comparative weakness in tension, especially at high temperatures; and in welding, particularly aluminum alloy castings, the chances of distortion or warping makes it somewhat difficult to keep the work in alignment.

In welding aluminum it is essential that the gases (oxyacetylene and oxyhydrogen) must be in a state of high purity, as at the high temperature of the oxyacetylene flame (approximately 3480° C. 6300° F.) aluminum tends to absorb nitrogen, and if this impurity exists in the oxygen it will render the weld brittle and unreliable. The temperature of the oxyhydrogen flame is about 2400° C. (4350° F.) and its use is limited to the thin gages (say up to $\frac{1}{16}$ inch). The oxyacetylene flame is therefore the most satisfactory of all gases for the heavier or stouter sections. Moreover, the use of the oxyhydrogen flame tends to produce oxidized welds and is somewhat slow in action, and consequently gives too much opportunity for oxide to form and be included in the weld joint. Experience shows that it is not merely a matter of temperature, but the chemical combination of the gases which has the greatest influence on the weld produced.

It is known to those who have attempted to join aluminum by autogenous fusion welding, that when two sheets or parts are to be welded together at their edges the melted portions do not flow together properly, as in the case of iron or mild steel, where the melting point of the oxide is lower than that of the metal. The molten aluminum spreads in spherical form under the influence of the welding flame. These metallic globules consist of pure aluminum within a coating of alumina (oxide of aluminum), which has great power of resistance to the flame,

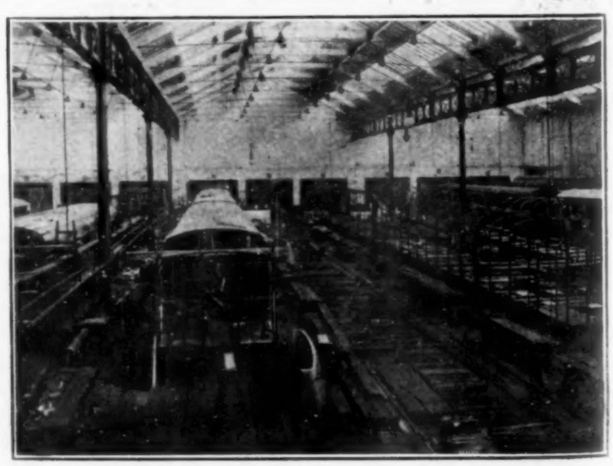


Fig. 2—Railroad Passenger Cars Under Construction, with Aluminnm Panels, Roofing, etc.

*Part I of this article was published in our issue of September, 1928.

and, on cooling, the edges of the metal remain unjoined; hence the need of a good flux to dissolve and deoxidize the layer of oxide and allow the fused metal to flow satisfactorily together. However, this layer or film of oxide may be removed or broken up by mechanical puddling. In the puddling process the welding operator usually uses a steel rod so as to thoroughly stir the molten metal, thereby allowing the metal to coalesce. When puddling methods are employed there is a possibility that some oxide which has a higher specific gravity than the metal will remain in the weld joint—interfering with its strength, and will lead in time to disintegration. In other words, a welded joint in aluminum without a flux never presents perfect homogeneity. The use of a flux is very much more satisfactory. It also obviates the use of scrapers and puddling tools. In autogenous welding it is known that the principal function of an aluminum welding flux is to dissolve and deoxidize the layer of aluminum oxide adjacent to the joint to be welded. Since the melting point of aluminum is 658° C. (1216° F.) and that of its oxide approximately 3000° C. (5432° F.) it is possible to melt the aluminum without melting the oxide, and in welding, the oxide is very difficult to disperse. In Fig. 3 is shown the existence of fluid or molten aluminum contained in a bag of oxide. The metal having liquefied, has caused the flexible bag of oxide to sag. In order to demonstrate the existence of aluminum oxide more or less in the form it would be included in a welded joint, the oxide has been pierced and the molten aluminum is seen running out. That is, the oxide which was almost imperceptible and very persistent in both soft soldering and welding of aluminum.

Fig. 4 shows a butt-welded joint made on aluminum rod by pressure welding. The collar of metal which has been squeezed out is largely composed of aluminum oxide. If the collar is removed by grinding, filing, etc., and

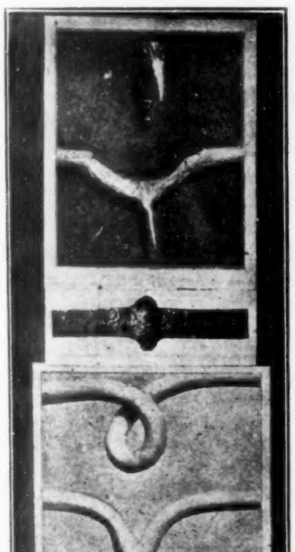


Fig. 3—Molten Aluminum in Oxide Bag

Fig. 4—Aluminum Rod Joined by Pressure Welding

Fig. 5—Welded Aluminum Rod After Bend and Twist Testing

afterwards polished, the joint is practically invisible. Pressure welding can be employed on aluminum rods of all sizes up to about 2 inches in diameter.

Fig. 5 illustrates a joint on aluminum rod 3/8 in. in diameter that has been tested by bending and twisting, after the removal of the collar. The removal of this collar is not always necessary in service.

FLUXES FOR AUTOGENOUS WELDING

Aluminum welding fluxes now employed extensively with very satisfactory results, consist of various combinations of alkaline chlorides, fluorides, bisulphates, etc. They are used in the form of a very fine powder and as a paste. To prepare a paste flux, the powder is usually dissolved in clean cold water to the consistency of a fairly thick cream. This is then applied to the joint with a brush, or it may be applied to the welding rod.

A good flux for aluminum or aluminum alloys with a melting point of about 600° C. may be made from a mixture of lithium chloride, potassium chloride, potassium bisulphate and potassium fluoride. The reactions which take place in fluxing aluminum are believed to be as follows: The potassium fluoride reacts with the potassium hydrogen sulphate, forming hydrofluoric acid, and this immediately acts on the aluminum oxide, forming aluminum fluoride, which is free to combine with the excess of potassium fluoride existing in the flux to form potassium aluminum fluoride, and this is capable of dissolving a further quantity of aluminum oxide. The lithium and potassium chlorides added serve the purpose of lowering the fusion point of the mixture.

Another view is that the potassium bisulphate may act partially alone, for on heating this salt to a temperature higher than its melting point it forms potassium pyrosulphate, and on further heating breaks up into potassium sulphate and sulphur trioxide. As this decomposition takes place at about 600° C, it can be understood how the bisulphate will decompose substances like cryolite and calcium fluoride at a lower temperature than that required to fuse the mineral or salt itself.

Aluminum welding fluxes should be used sparingly and therefore should not be thrown on the weld in excess as the brazier or coppersmith does when brazing copper or brass. The powdered fluxes are best applied from the welding rod; this can be done by heating the end and dipping it into the flux, which readily adheres to it. It should be unnecessary to apply more flux to the weld joint than that which coats or varnishes the welding rod or strip material for a distance of 4 to 6 in. The gradual melting up of the rod as the weld proceeds will automatically feed flux on the weld joint where it is required and at a uniform rate.

The accompanying table gives the compositions of several fluxes commonly used for welding aluminum or aluminum alloys, but most of these are patented compounds:

FLUXES FOR ALUMINUM WELDING

Potassium Chloride	Sodium Chloride	Lithium Chloride	Sodium Sulphate	Potassium Sulphate	Sodium Bisulphate	Potassium Bisulphate	Sodium Fluoride	Potassium Fluoride	Cryolite (Aluminum Sodium Fluoride)
83.0	17.0	....	..	..	..	..	....	..	....
79.0	16.0	....	..	5.0	..	..	....	..	....
62.7	12.5	20.8	..	..	..	4.0	....	..	....
62.5	32.5	....	..	5.0	..	..	....	..	....
60.0	12.0	24.0	..	..	..	4.0	....	..	....
56.0	6.5	23.5	4.0	..	..	..	....	..	10.0
45.0	30.0	15.0	..	..	..	3.0	....	7.0	....
45.0	27.5	17.5	..	..	3.0	..	....	7.0	....
33.4	....	33.3	..	..	..	..	33.3	..	....
4.2	79.2	7.4	..	..	..	..	....	..	9.2
....	86.0	....	14.0	..	..	..	....	..	....

WELDING MATERIAL

For autogenous welding of sheet aluminum and products fabricated from pure metal, the filling-in material should consist of a strip, rod, or wire of pure aluminum. For aluminum alloys the welding material should be of approximately the same composition as the alloy to be welded, in order to produce a uniform weld joint. When pure aluminum is used for jointing aluminum alloys the welded area will be softer and more flexible than the alloy material. This condition, of course, is undesirable, especially in the case of automobile castings where great

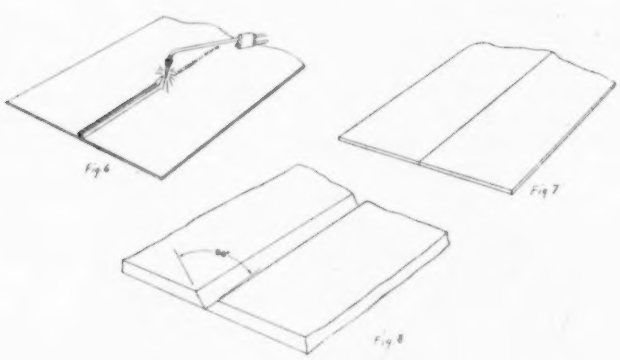
strength is required to enable them to withstand road shocks, stress and excessive vibration. Welding wire and rods should be of a diameter slightly greater than the thickness of the metal to be welded. The minimum size of wire or rod commonly used is about 3/32 in. in diameter, while even for thick sections rods over 5/16 in. in diameter are rarely used. Special alloy welding rods for welding aluminum alloy products are obtainable from the makers of autogenous welding equipment.

PREPARATIONS OF METAL FOR WELDING

Proper and thorough preparation of the metal to be welded has an important bearing, both on the quality of the weld and the total cost of the work. The welding operator should remember that any aluminum job to be welded must be properly prepared, cleaned and the parts lined up, held rigidly in place, etc., before any attempt is made to commence actual welding. The time spent in cleaning an aluminum joint and the adjacent areas, removing all foreign matter, will be well employed. An aluminum weld should be kept free of everything except the welding material and flux.

A stiff bristled steel brush is a very useful tool for removing oxide, dirt, etc. For removing oil and grease from aluminum machine parts or automotive castings, these should be immersed for a few seconds in a hot caustic soda bath. A 10 per cent caustic soda solution is satisfactory for this purpose. After being removed from the bath, the products or components should be thoroughly washed and brushed with clean water.

In production welding and repair work, various jigs and fixtures can be devised. The judicious use of jigs and fixtures invariably makes it possible to overcome



Methods of Welding Aluminum Sheet and Plate

distortion in the finished products, reduce the cost by increasing the speed of welding, and in aluminum production work, assures standardization. In other words, a better-looking piece of finished work is the result when jigs are used to hold parts in alignment and to eliminate distortion. Thin aluminum sheets, up to, say, a maximum of 1/16 in. thick, may have their edges flanged at right angles as shown in Fig. 6, the flanges having a height of about one and a half times the thickness of the sheet. With this method no additional welding material is necessary, the edges are melted up and provide the necessary material for the weld. When aluminum sheets or plates are from 1/16 in. to ⅛ in. in thickness it is preferable simply to butt the edges together as shown in Fig. 7. Above ⅛ in. in thickness both edges should be beveled to an angle of 45°, so as to form a right angle at the weld, as shown in Fig. 8, thereby permitting a ready penetration through the whole thickness. The beveling on aluminum sections over ½ in. in thickness should be in the form of an X, the angle of each side being about 90°.

EXECUTION OF WELDS IN ALUMINUM

In welding aluminum or aluminum alloys, the phenomena of expansion and contraction must be guarded against by preheating and annealing the work effectively, or distortion, cracking or internal strains may result—particularly in the case of intricate castings.

Preheating is advantageous in that it saves gas, increases the speed of welding, and in the case of automobile parts it expels grease and oil, which generally are retained by the porous material in considerable quantity. Should a repair be carried out before the oil is expelled the oil will carbonize and adhere to the edges where the weld is to be effected, thus preventing sound work.

The maximum limit of preheating temperature is about 450° C. (842° F.). Above this temperature aluminum and its alloys become very fragile and is liable to collapse. It is not necessary, however, to preheat all aluminum jobs. For example, a lug or corner broken off the flange of an automobile crankcase or gear box can be welded perfectly by commencing to heat up the corner of the casting with the torch flame, giving it plenty of time for the heat to radiate and welding when it is at the right temperature. Many contrivances are in use for preheating and annealing and maintaining the necessary heat during welding; various designs of furnaces are often employed, using wood charcoal or charcoal mixed with coke. Gas, oil and the welding torch also is often used in preheating aluminum products to be welded.

In the actual operation of welding, the torch flame must be carefully regulated and the correct adjustment of the gases maintained. The proper adjustment is secured with a very slight excess of acetylene, although the neutral flame can be used satisfactorily. The smallest excess of oxygen in the welding flame should be carefully avoided otherwise the material is rapidly oxidized. In order that the metal will not melt too rapidly, the tip of the white cone of the torch flame should not come in contact with the metal, but should be held away ⅛ in. to ½ in. varying with the thickness of the work. The torch should be inclined at a suitable angle from the flame of the weld—from 45° to 60°—and its motion should be away from the welding operator. The torch flame must be so applied that both sides of the joint will be heated and melted equally and simultaneously. Once welding has commenced it should progress to completion without interruption. Sheet aluminum welds should be expeditiously executed from the moment the first fusion is obtained. The speed of welding is not uniform, but accelerates as the weld proceeds.

After the weld is completed the work should be allowed to cool very slowly, especially in the case of complicated alloy castings, so that all parts shall contract uniformly. A good plan is to completely cover the hot casting with asbestos, sand or lime, which has previously been warmed, for 20 to 24 hours. This treatment not only removes the possibility of internal stresses, but often results in a definite improvement in the mechanical properties of the metal itself.

Afterwards, the welded joint and the surrounding metal must be thoroughly cleaned by washing and brushing with plenty of hot water to remove all traces of the flux which would otherwise continue to produce a chemical action on the metal that would result in harmful corrosion. In some welding plants the welds and the adjacent areas are washed with a 5 to 10 per cent solution of sulphuric or hydrochloric acid. After this treatment the work should be thoroughly washed in plenty of clean water to remove any of this acid solution that may be left.

This article will be continued in an early issue.—Ed.

The Fundamentals of Brass Foundry Practice

A Description of the Basic Laws Which Control the Melting and Casting of Metals and Their Application to Practical Foundry Work—Part 20*

By R. R. CLARKE
Foundry Superintendent

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE SKIM GATE

SKIM gates are purely mechanical devices to clarify delivering metal. In design they vary widely; in basic principle there is much of sameness about them; in objective they are identical. Their necessity derives from the curse of pollution from which no molten metal is entirely free. This pollution sets up from oxides, dross, scale, slag, sand-sweepings, etc. They ride the metal surface or are incorporated in its body mass and carried with it to the casting. The function of the skim gate is to unload the delivering metal of these polluting substances, to isolate these substances and hold them free of the casting.

Practically all skim gating is based on the principle that bodies lighter than metal can be either held back of the delivering channel or carried past it to some point of deposit and held there. From this, two distinct orders of skim gate appear, the choking or restraining order and the deflecting order. Both are different types and there are different instances where both are involved in the same

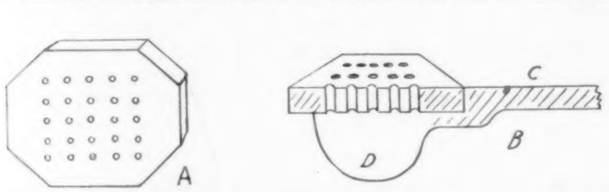


Fig. 64—Perforated Skim Gate Core. A, Front View. B, Cross Section of Core and Gate. C, Runner Gate. D, Pool or Button

unit. Of the choking type there are mainly three forms: (1) the perforated core, (2) the thin gate section, and (3) the bottom delivery. The first is simply a core so compounded as to withstand hard metal service and containing a multiple of small holes (⅛ to ¼ diameter) so spaced as to give the core a sieving function. It is simply a sieve core and is illustrated in Figure 64. This core usually rests at the pouring sprue bottom in a core print accounted for in the runner gate at that point. This runner gate extends backward under the strainer core thence forward to the casting to be run. The method prevails in gated-up and plate-mounted work, though by using a runner gate section containing the core print, it can be made equally applicable to loose work. The principle is that no metal can enter the runner without first passing through the strainer core by which its dross is excluded. The core serves the dual purpose of straining the metal and choking the sprue so as to keep it full during pouring.

The method is fairly well known and undoubtedly contributes to cleaner castings. Practice however, detects minor weaknesses of its constitutional make-up. First, the point of choke and of resistance lies at the point of greatest metal force and impact, making for a strong tendency to drive the polluting bodies through the core mesh. The tendency is of course greatest at pouring beginning, though more or less active throughout. A further disadvantage is the lowering temperature of the metal by partition in the core mesh. This, added to the slowness of metal delivery through the core to the runner gates results in a tardy, listless movement of runner and delivery current which is rather contradictory to the average of best practice. Experience will scarcely question the much featured advantage of pouring a casting through well-filled gates up to as close to the delivering point as possible before putting any check on the metal. With the perforated core the point of check approximates a maximum distance from the point of delivery and denies the metal this bettering condition. The core meshes can of course be enlarged to transmit greater volume, but in that case its sieving is proportionately diminished. A still further handicap is that the core cuts the feeding and the pressure of the sprue metal to the freezing of the metal in the mesh and unless a second sprue intervenes between the core and the casting, it limits the field to those castings requiring little or no prolonged pressure and feed.

On special occasions a devised srainer core is sometimes used in the runner gate so inset as to be shifted at the instance of pouring finish to allow full pressure and feed. The principle appears in Fig. 65 and involves getting the check closer the delivering point as well as realizing full

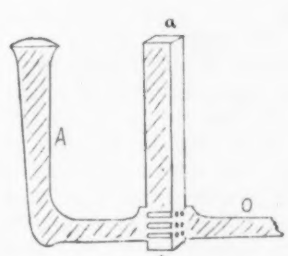


Fig. 65—Devised Strainer Core for Job "ab"

pouring sprue effect by lifting the core up to clearance at the pouring finish. Though quite efficient, the method is rather impractical in every-day foundry work. Practice sometimes is to place the strainer core in the sprue head or a distance beneath it, instead of at the bottom, as shown in Fig. 66. Cores so placed are frequenty designed to float at pouring finish and clear their interference with feeding.

All that might be said against the strainer core at the bottom can be amplified against working it upward in the

 This series will be collected and published in book form. Parts 1 to 19, inclusive, were published in our issues of July, August, September, October and November, 1926; January, February, March, April, May, August, September, November and December, 1927; and March, April, May, August, September and December, 1928.

sprue. Regarding its capacity to float at pouring finish, when the metal is hot and fluid, they mostly do; when the metal is dull and viscous they often do not. On the whole, general principles surely disagree with the method.

The rain gate, previously mentioned, is practically a

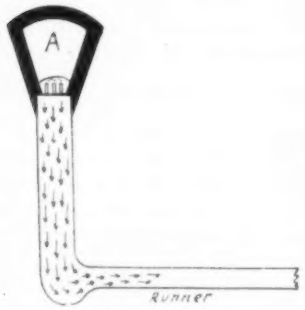


Fig. 66—Strainer Core Used in Pouring Head

strainer core rammed up with the cope and directly over the casting mold as in an end-poured bushing. A pouring head is made over the core and the metal poured or "rained" directly into the mold. Castings of high quality have been realized in this manner. One of the advantages of dropping metal in "drops" or particles derives from the principle that the smaller a body is the greater its surface compared with its volume, by which greater surface the resistance of the atmosphere greatly retards its velocity. Because of this, dust particles settle very slowly, mist falls scarcely perceptibly while rain drops are held to harmless descent. Similarly in the rain gate, the unit mass of metal, its velocity and its impact are all cut harmlessly down in dropping to the mold bottom. It has the further advantage of dropping directly down clear of the mold walls, of satisfying the demands of shrinkage previously referred to, and of entering the mold clean, free of gate sweepings, directly and quickly. The objection of partition can be rendered all but negligible by using a strainer core sufficiently expansive to pass and at the same time partition a volume of metal equal to a hard pouring rate. The efficiency of the process of course increases with the common sense methods in details of having the pouring head not too shallow, of not pouring directly over the mesh openings but rather to the side of them, of keeping the head always full, etc.

THE THIN GATE SECTION SKIM

This is simply a "shallowing" or narrowing of the gate channel somewhere between the pouring sprue and the delivery point. Its simplest form is the broad, thin delivery gate, usually in multiple, used either exclusively to run the casting or to run and feed castings where the feeding requirements are very low. By this method metal in bulk is brought close up to the delivering point and there strained of its dross. It has the advantage of well filled gates, a full choked sprue, a spacious gate repository for dross, a body of live, active metal close to the casting, a minimum of friction and impact and a happy exemption from the gate draw or pin hole in the casting. In sizing these delivery gates they should be made shallow enough to strain metal. If then incapable of carrying sufficient volume to satisfy the running conditions, they should be broadened rather than deepened; either that or additional deliveries cut. An advantage of multiple delivery is that it subjects no one part of the mold to excessive heat and current metal action.

Another very common form of the thin gate section is shown in Figure 67 and involves the narrowing of the runner gate back of the delivery gate. Correct principles of this form insist that it be broad and thin, neither too long nor too short (about 3 inches average) always a safe distance from the bottom of the sprue, as close to the point of attachment to the casting as judiciously permissable and sized to a volume of transit in keeping with the requirements at hand. A skim gate too large neither chokes nor skims while one too small might fail properly to run the casting. A further item is that the position of skim is better at the bottom as at A than at the top as in B of the channel.

In the thin gate section, the pouring sprue, as in the bottom perforated core, exercises little or no feed or pressure on the casting and often necessitates a second sprue

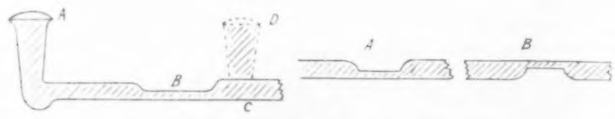
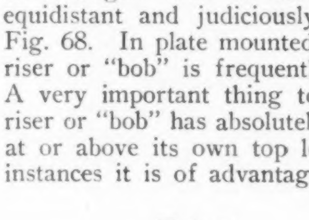


Fig. 67—Thin Gate Section

somewhere between the skim and the casting or castings as at D in Fig. 67. When a limited number of castings are involved in the same mold, their gating points should be arranged close to each other, and the feed sprue equidistant and judiciously close to these points as in Fig. 68. In plate mounted and in gated work, the blind riser or "bob" is frequently used as this feeding agent. A very important thing to remember is that this blind riser or "bob" has absolutely no effect of feed or pressure at or above its own top level in the casting. In many instances it is of advantage to function the pouring and



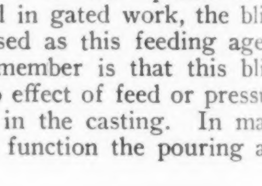


Fig. 68 (Left)—Close Arrangement of Gating Points. Fig. 69 (Right)—Constructive Principles of Gate

runner gates exclusively to metal delivery (Fig. 69) and depend on a riser at some other point to furnish pressure and feed. In this method lies the ideal possibilities of purging the delivered metal.

Bottom gating favors cleanliness in that as the mold fills, the sprue level is always higher than the delivering point and naturally holds dross to the sprue metal surface and away from the casting. Force of current, of course tends to defeat this end though not entirely and bottom poured castings are generally cleaner than the same castings top-poured. In bottom pouring, the cleanest castings are those in which the metal comes up from under the casting lowest point.

This series will be continued in an early issue.—Ed.

Plating Room Floor Composition

Q.—Can you give us a formula for composition floors for an ordinary plating room? We understand that such a formula was published in your magazine lately but have been unable to locate it.

A.—The best material for a plating room floor that will withstand both water and acids is reinforced concrete covered with asphalt or some other bituminous material.

—OLIVER J. SIZELOVE.

Sands for Different Classes of Work

Experiments on Various Types and Grades of Sands for Brass and Aluminum Castings

By P. W. CRANE
University of Cincinnati

FROM A RECENTLY ISSUED REPORT OF THE COMMITTEE ON MOLDING SAND RESEARCH, AMERICAN FOUNDRYMEN'S ASSOCIATION

SINCE the use to which a molding saud may be put depends entirely upon its physical properties, and since reliable tests have been developed for measuring these physical properties, it should be possible to establish specifications for sands to be used for specific types of castings, in terms of the test figures. These specifications would involve certain limits of fineness, permeability, and strength, found by experience to give the best results for each type of casting.

In the past, the successful selection of a sand for a particular class of work depended entirely upon the experience and skill of the foundryman. The appearance of the sand and its feel, and finally its actual success in the heaps, were the only means available for judging its merits. Often the judgment of two foundry superintendents would differ widely concerning a sand to be used for a particular job.

The Survey Laboratory was interested in learning for what purposes local sands were being successfully used: also whether any similarity existed between the sands used by different foundries making the same class of work. The theory of the Laboratory was that there must be a sand which will give the best results for each type of work, and that it might be possible to determine the approximate characteristics of such a sand by testing the heaps of a number of leading foundries and comparing results. Such comparisons, it was thought, would soon show whether or not the setting up of sand specifications, for various classes of work, was feasible.

Accordingly, as much test data on foundry heaps as possible was obtained, chiefly by testing actual heap sands. Other test data was secured from foundries, and producers, and through the courtesy of the American Malleable Castings Association.

It was quite evident, even at first, that different types of foundry practice would have a certain amount of influence upon the kind of sand used, even on identical types of castings. An effort was therefore made to obtain as much information as possible concerning methods of treating the sand, type of ramming, amount of core sand going into heap, use of facing, addition of sea coal, pitch, or other material, and the use of blacking. Most of this information was obtained by correspondence and was far from satisfactory, except in a very few cases. Many of the foundries either did not care to release the data, or were indifferent or not interested. Also, since both time and funds were limited it was not possible to make a thorough study of this problem. Insufficient information was obtained to warrant anything but very general conclusions.

LIGHT TO MEDIUM BRASS

The results for nineteen brass foundry heaps appear in Table 13. The average values for the group are: Permeability, 11; strengths, 170; fineness, 217, and bonding substance, 12. Sands Nos. 10 and 11 were obtained from very progressive foundries which are known for their good castings. The permeabilities of these sands are the highest in the group and are considerably higher than the average. A glance at the figures of these sands, for bond content and fineness, reveals the fact that the high permeability is not obtained by using a coarse sand, but by employing a minimum amount of bonding material. The strength is lower than that of other sands, but both foundries reported no trouble due to washing, or other signs of weakness. The surface of the castings was excellent. Limits for this class of work might be fixed as follows: Permeability, 10-25; strength, 130-170; fineness, 190-240, and bonding substance, 7-12. The fineness curves show considerable variations in grain size distribution. The very fine sand 18, was used in combination with plumbago as a facing for ornamental castings and tablets. A heavy sand was used as a backing. This, to the writer's knowledge, is the only sand in the entire list used strictly as a facing.

TABLE 13. LIGHT TO MEDIUM BRASS

Type of Work:	R. S. Grade No.	A. F. A. Fineness Factor	Bonding Substance, Per Cent	Moisture, Per Cent	Permeability, A. F. A.	Strength, A. F. A. Bar Method
1 Light jobbing	64	196	24	9	9	210
2 Light jobbing	81	263	8	9	12	144
3 Light jobbing	91	280	9	6	5	164
4 Light jobbing	71	239	7	7	5	141
5 Light and medium jobbing	62	181	12	8	12	202
6 Light and medium jobbing	71	234	7	7	10	181
7 Light and medium jobbing	95	276	25	8	5	164
8 Light and medium jobbing	62	188	13	9	8	170
9 Valve castings	72	215	11	9	8	175
10 Valve castings and jobbing	61	191	7	6	23	140
11 Valve castings	61	209	9	10	22	132
12 Machine tool bushings, valves	64	204	20	7	6	160
13 Bronze locomotive and journal bearings	75	217	17	8	13	183
14 Journal bearings	44	145	20	9	22	183
15 Bronze tablets	62	189	14	9	8	176
16 Ornamental castings	62	191	12	6	15	191
17 Ornamental castings	62	203	11	8	14	161
18 Ornamental castings	92	291	13	6	6	221
19 Ornamental castings	62	224	14	7	14	138

HEAVY BRASS

Only three sands used for heavy bronze castings were tested by the laboratory. The figures for these appear in Table 14. No attempt is made to fix limits for this type of work because of the small number of samples tested.

TABLE 14. HEAVY BRASS

Type of Work:	R. S. Grade No.	A. F. A. Fineness Factor	Bonding Substance, Per Cent	Moisture, Per Cent	Permeability, A. F. A.	Strength, A. F. A. Bar Method
1 Marine castings	31	103	6	8	38	135
2 Pump castings	34	94	20	7	80	191
3 Machinery castings	42	128	10	7	36	142

ALUMINUM

The test figures for a number of aluminum sands are given in Table 15. Nearly all of them are very fine and have fairly low permeability values. The strength figures are high, probably due to the fact that most of the fine sands are naturally high in bond content, and also that the low temperature at which the metal is poured does not cause a rapid deterioration of the sand. The extreme values of the various properties are: Permeability, 4 and 18; strength, 140 and 195; fineness, 136 and 294; bond content, 7 and 34. The writer is only familiar with the castings made in three of these heaps, Nos. 6, 9, and 11. Of these the ones from the finest heap were the best in appearance. Those from heap 11, the coarsest one, also had an excellent surface, for which the high bond content was probably largely responsible. The limits suggested for aluminum sands are: Permeability, 5-15; strength, 130-170; fineness, 180-190; bonding substance, 8-25.

TABLE 15. ALUMINUM

Type of Work:	R. S. Grade No.	A. F. A. Fineness Factor	Bonding Substance, Per Cent	Moisture, Per Cent	Permeability, A. F. A.	Strength, A. F. A. Bar Method
1 Jobbing	71	234	7	9	10	176
2 Jobbing	96	280	34	8	4	175
3 Jobbing	92	294	14	7	4	166
4 Jobbing	94	290	24	8	4	181
5 Jobbing	65	208	25	8	12	193
6 Jobbing	62	188	13	8	8	168
7 Electric motor shells	81	263	8	9	12	140
8 Machinery parts	62	191	12	9	18	185
9 Small castings	91	280	9	6	7	186
10 Automotive castings	92	279	11	9	6	161
11 Automobile castings	44	145	24	10	9	164
12 Small auto. castings	84	265	24	8	4	181
13 Cast. for elec. work	44	136	22	8	6	195

Meeting of Electroplaters' Research Committee

THE Research Committee of the American Electroplaters Society will hold a conference on Saturday, April 6th, at the Elks Club, Newark, N. J. The Committee made this change from Washington, D. C., to Newark, N. J., to make it more convenient for the people from different sections of the country.

The purpose of this conference is to receive reports on the work done by the Bureau of Standards and the Associates under the direction of the American Electroplaters' Society and to receive a report on the funds by the treasurer, and any suggestion and plans for the future work at the Bureau.

A tentative program has been outlined as follows:

MORNING SESSION, 9-12, OLIVER J. SIZELOVE, PRESIDING

1—Spotting Out:

W. P. Barrows—(Research Associate, American Electroplaters' Society).

2—Chromium Plating:

(a) W. Blum—(Bureau of Standards). "Outline of Researches at Bureau of Chromium."

(b) H. R. Moore—(Bureau of Standards. "Conductivity of Chromic Acid Solutions."

(c) H. L. Farber—(Research Associate, American Electroplaters' Society). "Throwing Power in Chromium Plating."

(d) General discussion of chromium plating problems.

3—Analysis of Cyanide Plating Solutions:

M. R. Thompson—(Bureau of Standards).

AFTERNOON SESSION, 2-5 P. M., R. J. O'CONNOR, CHAIRMAN, RESEARCH COMMITTEE, PRESIDING

4—Measurement of pH Nickel Plating Solutions:

(a) W. Blum—"Outline of the Investigation."

(b) Statement of Results by:
N. Bekkedahl (Bureau of Standards)
K. Pitschner (American Chain Company)
C. J. Rosecranz (Leeds & Northrup)
F. R. McCrumb (LaMotte Chemical Products Company)
A. K. Graham (University of Pennsylvania)
J. W. Burt-Gerrans (University of Toronto)

(c) Summary of pH.

5—General Discussion of Nickel Plating problems:

6—Addition Agents in Copper Electrotyping Solutions:

R. O. Hull (Research Associate, International Association of Electrotypers).

7—Iron Deposition:

C. T. Thomas—Bureau of Engraving and Printing.

8—Future Plans:

All persons interested in the above subjects or work are invited to be present in person or by representation.

White Finish for Aluminum

Q.—Is there an acid or solution that can be used for dipping aluminum alloy castings in order that a brighter luster can be had after dipping them? If there is an acid or solution that can be used for this purpose, please let me have the recipe for mixing it.

A.—To produce a white finish on your aluminum castings, we would suggest that you use the following procedure:

If the castings have had any drilling or machining operations performed on them, free them from grease or oil by the use of naphtha or gasoline.

Prepare a caustic soda solution by dissolving 4 ozs. of caustic soda in each gallon of water and heat to 180° to 200° F. Place the castings into this solution until a large evolution of gas occurs. Rinse in clean cold water and then run through an acid mixture composed of 1 part sulphuric and 1 part nitric acid. Rinse in clean cold water, pass through a cyanide dip made of 6 ozs. of sodium cyanide to 1 gallon of water and finally dry through clean hot water and dry in hardwood sawdust.

—OLIVER J. SIZELOVE.

Zinc Sulphate Solution

Q.—Can you give me the formula for a good galvanizing solution for large work? I need one with good throwing power. I have been using the following solution:

Water	1 gal.
Zinc salt	1 lb.
Epsom salt	1 lb.

This solution takes quite a time to travel into the corners of the work I am galvanizing. Can you help me with this

A.—Formula for zinc sulphate solution:

Zinc sulphate	32 ozs.
Ammonium chloride	2 ozs.
Aluminum sulphate	4 ozs.
Grape sugar	2 ozs.
Water	1 gal.

Use at room temperature; current density, 20 amperes per sq. ft.; pure zinc anodes. For proper anode corrosion, add a small amount of sulphuric acid, 1/4 to 1/2 oz. per gal., at regular intervals.

—OLIVER J. SIZELOVE.

Banquet of the New York Platers

THE annual banquet and educational session of the New York Branch of the American Electroplaters' Society was held on February 16th at the Aldine Club, 200 Fifth Avenue, New York. More than five hundred attended the banquet.

The educational session began at 3 o'clock. Frederick Haushalter, chairman of the Banquet Committee, opened the meeting and welcomed the guests. Addresses were made by F. J. MacStoker, president of the Branch, and Charles H. Proctor, founder of the A. E. S.

Abstracts of the papers presented are given below.

FLEXIBILITY AND ADHESION IN MODERN LACQUERS

By Leo Roon, Technical Director, Roxalin Flexible Lacquer Company, L. I. City.

This paper discussed the special qualities in lacquers for metals, namely, adhesion, durability and flexibility. A number of exhibits were shown exemplifying the differences in various lacquers. Mr. Roon discussed the importance of the newer methods of applying lacquers, worked out in the last few years by lacquer manufacturers. He showed that platers and finishers profit greatly by looking into the many new lacquers developed specially for metals. The art of finishing and the manufacture of coatings for metals are moving rapidly and the metal finishing trades should watch these developments closely, keeping in touch with anything new that appears.

MECHANICAL PLATING METHODS AND FORMULAE

By F. J. MacStoker and W. Strein.

This paper described mechanical plating methods from a practical standpoint, in the plating of a wide variety of small articles in a large number of finishes. The authors, who are in charge of a large plant, described their own methods in detail, telling just how the work was done. They pointed out that the most important, and in many cases the most difficult, part of the work consisted in the preparation for plating. In their plant only cold solutions, rinses and cleaning dips are used. No heat is applied in any of the operations, as methods have been developed for doing all work at normal temperatures.

The authors exhibited a number of articles finished in copper, brass, nickel, cadmium, zinc, Parkerizing, blued steel, and black finishes.

A number of addresses were made by members of the Society from other branches, who were called upon by Mr. Proctor. Horace H. Smith, supreme president of the Society invited everyone to attend the annual banquet and session of the Newark Branch on April 6th. The Research Committee of the Society will also meet in Newark on April 6th, holding their meetings in conjunction with the program of the Newark Branch. Others who spoke were G. B. Hogaboom, George Gehling, F. C. Mesle and Dr. Blum.

The banquet followed the meetings and was a brilliant success, a combination of a fine menu, good music and high-spirited guests. Dancing followed the dinner.

FACTORS THAT CONTROL CHROMIUM PLATING

By Oliver J. Sizelove, Chemical Editor, The Metal Industry

This paper showed that careful control is the most important factor in the deposition of a good coating of chromium. Mr. Sizelove pointed out the importance of the work of Dr. Blum at the Bureau of Standards and Richard Schneidewind at the University of Michigan. He gave his conclusions from his own experimental work and the practical application of these conclusions. Special attention in chromium plating must be devoted in the temperature of the solution, current density, chromic acid concentration, trivalent chromium, anodes, and sulphate content in the solution. Mr. Sizelove did not believe that the plater had to be an expert, electrical engineer or chemist, but he must know something about these fields, in order to operate chromium solutions successfully. Methods of analyses should be known; also the methods of handling electrical equipment and controlling current.

He stated that in his experience lead anodes were as good as a combination of lead and iron anodes.

Mr. Proctor in discussing the paper, offered the opinion that the use of iron anodes together with lead was a good thing in chromium plating. Practice in the Middle West is fairly general in the use of iron anodes.

SIMPLIFIED METHODS OF CHEMICAL CONTROL

By C. L. Pan, Instructor in Electroplating, College of the City of New York.

Dr. Pan phrased in simple terms, the complex descriptions of methods of chemical control. Using charts, he showed a number of methods which could be easily applied for determining the various constituents of plating solutions, such as acid content, pH, free cyanide, free alkali, free metal, metal in solution, etc. According to Dr. Pan's exposition these charts eliminate a large part of the mathematical work necessary in making analyses of solutions. The platers were deeply impressed with this paper and high praise was voiced by Mr. Proctor and Mr. Hogaboom.

International Fellowship Club

The annual luncheon of the International Fellowship Club was held at the Aldine Club, New York City, on February 16, when the New York Branch held its annual educational session and banquet. The luncheon was largely attended and there were several addresses. Frank J. Clark presided, with the assistance of Benjamin Popper, secretary.

R. A. Balzari, assistant general manager, McGraw-Hill Publishing Company, New York, delivered an address on "Selling." Dr. William Blum, electroplating expert of the United States Bureau of Standards, spoke on "Research in Sales." A. P. Munning, chairman of the board of directors, Hansen-Van Winkle-Munning Company, Matawan, N. J., gave a talk on "Sales."

Anodes for Cadmium Plating

Q.—We do cadmium plating in our plant and so far have been using stud anodes about 5 inches in diameter, spaced about 10 inches apart on the hanger bar. We are considering using slab anodes made of slabs of cadmium about 4 inches wide and 3/4 inch thick.

Is there anything against using these slab anodes in place of the studs?

A.—Cadmium anodes 4 inches wide and 3/4 inch thick can be used in a cadmium solution in place of the discs you are now using. In cadmium plating, the anode disintegrates very fast at the solution level and causes the anode to drop to the bottom of the tank. This factor may be overcome by making a rack of iron to hold the anodes in a vertical position, thereby reducing scrap considerably.

—Oliver J. Sizelove.

The Barrel Burnishing of Metal Products

An Analysis of Burnishing and Tumbling Metal Pieces in Barrels—Part 2, Conclusion*

By H. LEROY BEAVER
Philadelphia, Pa.

FROM A PAPER READ AT THE ANNUAL BANQUET OF THE PHILADELPHIA BRANCH, AMERICAN ELECTROPLATERS' SOCIETY, NOVEMBER 24, 1928

BARREL burnishing (and you will note this distinguishing term as compared to ball burnishing), is a process and not a piece of equipment· For carrying on the process an apparatus is required consisting preferably of a polygonal drum or barrel, which is subjected to rotation by some driving mechanism, the drum or barrel in turn subjecting the burnishing mass therein to rotation and the burnishing mass subjecting the articles within it to rotation.

RELATION OF SPECIFIC GRAVITY

Three elements enter into the process. (1.) The speed of rotation of the burnishing mass, relative to the size and shape of the articles being burnished, the movement of the mass being such as to affect only a restrained and slow displacement along the surfaces of the parts being burnished and so as not to dislodge them radially during rotation. (2.) The relative specific gravity of the burnishing mass and of the articles to be burnished, a relation which is always present, and (3.) The relative quantity of the burnishing mass to the size and shape of the articles to be burnished. In regard to the quantity of the burnishing mass in order that the process shall be carried out to the best advantage, it should be such that the parts to be burnished are substantially covered by the burnishing mass during rotation.

Now, in order to illustrate the foregoing proposition, let us take two articles widely apart in characteristics and we can best illustrate this by a composition billiard ball for the one extreme and a chrome alloy steel ball for the other, both the billiard ball and the steel ball being of the same diameter, viz, 2¼ inch. The barrel for the demonstration being of the regulation polygonal form, 17 inches in diameter and 24 inches long, having plate glass ends, and carrying a load of 480 lbs. of burnishing mass composed of ⅛ inch, 5/32 inch and 3/16 inch round steel balls in equal proportions, which filled the barrel to slightly more than ⅔ full. On the initial test the barrel was operated at a speed of 10 r.p.m., giving a peripheral speed of 23.6 feet per minute, and in the second test at 18 r.p.m., giving a peripheral speed of 58.6 feet per minute. The specific gravity of the above burnishing mass was 4.9, that of the billiard ball 1.7 and of the steel ball 7.8. You will note that the specific gravity of the billiard ball was materially less and of the steel ball materially more than that of the burnishing mass itself.

In both tests and at both speeds the billiard ball and the steel ball were placed in the same relative position deep within the burnishing mass, though the tests were conducted separately. Observing the operation, it was noted that the billiard ball was carried up to the surface of the mass and then rolled down the inclined plane of the mass to the side of the barrel, where it floated on the surface of the burnishing mass. In this same manner the steel ball was rotated within the burnishing mass, and at no time did it come to the surface of the mass, but was continuously under pressure within the mass.

If the relation of specific gravity of the articles to be burnished to that of the burnishing mass had no bearing on the subject, then the lighter billiard ball would have maintained the same relative position within the burnishing mass as the steel bearing ball, since they were both spheres, were both placed in the same relative position and operated upon in the same way. The theory, therefore, of the relation of specific gravity of the articles being burnished and of the burnishing mass is a demonstrated scientific fact.

A burnishing mass, though mobile, is not liquid. It exerts great pressure both when at rest and when in motion. When at rest it is difficult to force one's hand through the mass to the bottom of the barrel. Now the mass not being liquid, the billiard balls, and like articles whose specific gravity is materially less than that of the burnishing mass, do not float or burst to the surface by reason of any buoyancy, but are impelled to the surface by a force produced within the mass itself during rotation.

There are many forces operating on the articles within the burnishing mass, which, at a given instant, in mechanical parlance, are all resolved into one final or resultant force. It is this force— the resultant of all the forces—which impels the articles of lesser specific gravity to the surface of the burnishing mass, and they are never again able to regain a position within the mass. Such articles are unable to resist this force because of insufficient inertia. If they had greater specific gravity, hence greater inertia, they would be correspondingly better able to resist this resultant force. Articles of greater specific gravity than that of the burnishing mass are able to resist the force and hence to retain their position within the burnishing mass. Hence it is that the specific gravity of the articles to be burnished, or to put it in another way, the inertia of the articles, is a distinct factor in their resistance to the force trying to dislodge them.

Now let us take for example this 2¼ inch steel bearing ball weighing 1.676 pounds. The resultant force to which I have referred is a force which would produce on this ball a motion of rotation of the ball about its axis and also a motion of translation or dislodgement. This is because the resultant force so operating on the ball does not pass through the centre of gravity of the ball. If it did only one motion would be produced, viz., translation or dislodgement in line with the direction of the resultant force.

We find, too, that in following out these conclusions that any article of approximately perfect sphericity is better able to resist the force of dislodgement than any irregular shaped piece. This is more readily appreciated when it is considered that the stream of burnishing mass, acting upon projections or irregular portions of the articles being burnished, is inclined to throw them out of position, while in the case of a perfect sphere no such irregularities are presented; but perfect symmetry alone will not enable the articles to remain with the burnishing mass. This is amply demonstrated by the test on the lighter specific gravity billiard ball, which, due to insufficient inertia or specific gravity, was forced entirely out of the burnishing mass by the resultant force.

There are certain exceptions that may well be noted.

* Part 1 appeared in the February issue.

We find in the case of hollow shells of various metals that, when placed in the barrel they are immediately filled with the burnishing mass, hence the specific gravity of such shells is not the specific gravity of the shell itself but the resultant of the specific gravity of the shell and of the mass within the shell. This resultant specific gravity being greater than that of the burnishing mass in a material and not in a trifling degree contributes substantially to keeping such articles within the mass during rotation.

The extent of the resistance of the inertia of the articles to the resultant force of dislodgement is one of degree, dependent upon the extent of the force and the inertia. Even a slight addition to the inertia of an article may suffice to sway the result in favor of the article as against the resultant force and thereby retain it within the mass.

All of this brings us back to the character of the material composing the burnishing mass. There can be no adequate burnishing result without the resultant force of the friction of the mass against the articles being burnished. A true sphere offers the least resistance, an irregular burnishing piece offers substantially more resistance, hence its greater efficiency for burnishing work.

RELATION OF SPEED

As between perfect spheres and irregularly shaped articles we have, on account of the symmetry of the sphere, a very different system of the combination of forces and impulses from what we would have acting in the case of more irregularly shaped articles. As the articles range away from the basis of the true sphere toward irregular shapes, an adjustment or control of the speed of the barrel must be exercised commensurate with the remoteness of the article from the true sphere. In other words, the more irregular the article, the more need for control or adjustment of the speed of the barrel. For example, a barrel operator may have a wide variety of shapes to burnish and it is safest for him to regulate the speed of his barrel, in order to avoid continual change of barrel speeds, to that speed at which the most difficult articles are best operated upon and this will generally be a comparatively low speed which will not dislodge the article from the burnishing mass. This low speed would be the one adopted for the more difficult pieces having a size and shape requiring a lower speed than the others. Other articles in this group could be burnished at a higher speed, but the comparatively lower speed, having been adopted for the more difficult articles, will be equally effective in the burnishing of the complete group.

Inasmuch as no hard and fast rule can be laid down regarding the proportion of burnishing mass to parts to be burnished, the best specification would be that the quantity of burnishing mass should always be such as to completely enveloped the articles being burnished during rotation, and this, undoubtedly, is the most satisfactory rule to follow in carrying out the process.

CLEANLINESS

Unquestionably, the highest development of the barrel burnishing process is found in a machine and process known in the trade as the Tahara Silver Burnishing Machine. Tahara is a word of Arabic derivation, signifying "Cleanliness." If there is anything at all in the expression that "Cleanliness is next to Godliness," it has no more apt illustration or application than in the barrel burnishing of metal products. Irrespective of the kind and grade of soap used as a lubricant, we must note that the base is composed either of animal or vegetable fats or oils, in other words, grease. This grease, with certain alkalies, constitutes soap. There is no commercial soap in general use that contains sufficient alkalies for proper burnishing work. Immediately the Alkali is exhausted from the base, the resultant grease or oil is left in the burnishing mass and deposited as well over the entire surface of the inner side of the barrel. It can only be removed by some alkali sufficiently strong to dissolve it and cause it to emulsify so that it can be washed away. In order to secure satisfactory results, both inside of the barrel and the burnishing mass as well must be kept scrupulously clean.

Not only this, but the parts to be burnished of themselves should be in equally as clean a condition. No operator can expect to place dirty, greasy or tarnished parts into his burnishing barrel and expect satisfactory burnishing results.

Chairman Scott: Are there any questions you would like to ask Mr. Beaver? I think this subject is a very interesting one and an important one. We all have our troubles and our ideas about burnishing, and here we have a man who has made a study of it, and I am sure he would be glad to help you. So if you have any questions to ask Mr. Beaver, we will be glad to have them now.

Geo. B. Hogaboom: I haven't a question, but Mr. Beaver spoke of the history of the barrels. It may be of interest to know that they did burnishing or polishing in France in the fifties, in 1850, and I happen to have a copy of the original Rossileur in French, and in that are two cuts of burnishing barrels, one of them a hexagonal barrel, very similar to what is being used today, and rotated by hand; the other was the skin of a goat that was sewed and just oscillated, and they used metal parts in there to burnish metal pieces, small parts of buttons, or they used pieces of wood that were cut in an irregular shape, hard wood, and were rolled in that barrel. I thought that might be of interest to Mr. Beaver.

When Mr. Parsons was going to sue the Baird people for an infringement, Baird came up and had photostats made of that page, and the case was thrown out of court.

Mr. Beaver: I think at that time what Parson claimed as a patent—I have gone into that to a considerable extent—Parsons claimed he was the originator of the use of a tumbling barrel, that that was tumbling. What I have tried today, Mr. Hogaboom, was to draw a distinction between what we know as tumbling and what we should know as burnishing, because, take it this way—you have a triple revolution, first the revolution of the barrel itself, second the revolution of the burnishing mass within the barrel, third the revolution of the article to be burnished within the burnishing mass. Now, by controlling the speed of the barrel, and holding at a low speed, and by confining yourself to an article whose specific gravity is greater than the burnishing mass, that article will remain within the mass, and the mass will revolve around it, and it will never touch the side of the barrel.

Mr. Hogaboom: The explanation is very lucid, and the paper, I think, is the finest I have ever heard on the subject of barrel burnishing, but I thought you would be interested to know they did burnishing in a hexagonal barrel operated by hand, turning it like a peanut roaster in 1850.

Zinc-Cadmium Solders

According to published reports, the new British dirigible R-101 will be made with cross bracing between the main longitudinal and transverse frames of all-steel cable, each strand of which is zinc-coated. The end connections will be made with "Cazin," a special solder composed of cadmium, 82.6; zinc, 17.4. This solder melts at 263° C. and takes on the galvanized coating of the wire without fluxes other than a little powdered resin.

A Study of Chromium Plating

Excerpts from a Bulletin Giving an Account of the Research Work Done on Chromium Plating at the University of Michigan During 1927 and 1928. Information Has Also Been Compiled from Scientific and Patent Literature—Part 2. Conclusion*

By RICHARD SCHNEIDEWIND
University of Michigan, Ann Arbor, Mich.

The Bath

The chromium plating bath has as its main constituent chromic acid. Its function in the bath is two-fold; to conduct the electric current, and to act as the source of supply of chromium. During the operation of plating chromic acid must be added from time to time.

A solution of chromic acid alone will not yield commercially valuable deposits of metal. It is essential that small quantities of sulphate or its equivalent be added in amounts about one per cent as great as that of the chromic acid used. The most convenient way of adding sulphate is through the use of sulphuric acid; chromium sulphate, sodium sulphate or any such material, however, can be substituted. Of these substances, however, more than one per cent must naturally be added. Carveth and Curry laid the foundations of this study, which was completed by Sargent, Fink, and Haring and Barrows. Substances functioning similarly to sulphates can be substituted, but no industrial concern is doing so.

If there is a deficiency of sulphate, the resulting deposit will contain areas of a brown hydroxide of chromium. As the amount of sulphate is increased, the quality of the plate is improved. When too great an amount of sulphate is present, good plate can be obtained only in a very narrow range of plating conditions. Still more sulphate makes the bath entirely inoperable.

The plating bath is usually quite strong; the chromic acid concentration in a recommended formula is about 250 grams per liter (32 ounces per gallon), the sulphate concentration 2.5 grams per liter (1/3 ounce per gallon). A stronger or weaker solution may be used, but the constituents must be in about the same relative proportions. Many baths contain other constituents either added intentionally or formed during use. Most substances of this nature, however, are detrimental rather than beneficial to the deposit.

Process of Deposition.

The cathode, the article to be plated, must be carefully cleaned of all grease, oil, and oxide. The grease and oil are removed by cleaning in a hot solution of alkalis, preferably with the aid of electric current in which case the piece to be plated is made the negative pole. Some foreign workers do not believe cleaning to remove grease a necessary step and they depend largely upon the detergent effect of the chromic-acid plating solution. Oxide is removed by pickling in acid; in the case of copper and brass, a solution of sodium cyanide works admirably. After it is rinsed, the piece is immersed in the chromic-acid plating bath, connected to the negative side of the circuit, and the current is applied.

In plating with nickel, silver, copper, or almost any other metal, if a small current is applied, deposition takes place slowly; if a large current is applied, deposition is rapid. The amount of plate formed is dependent upon the total amount of current supplied.

Chromium deposition is a much more complicated process. If a very low current density is used, the current merely reduces the chromic acid to trivalent chromium without any deposition of metal whatever. Current density is current per unit area and is usually expressed as amperes per square foot or amperes per square decimeter. As the current density is increased, a point is reached where suddenly an evolution of hydrogen is noticed at the cathode. Upon examination it will be found that, in addition to reducing chromic acid as before and liberating hydrogen, the current also has brought about the deposition of chromium. Only a very small fraction, under 5 per cent of the current at this stage actually is used in metal deposition. The plate is generally milky in appearance. Increasing the current density increases the current efficiency and the resulting deposit is brilliant. If put on a buffed surface, the plate will be so bright that no subsequent buffing is necessary. Increasing the current density still farther so that the current efficiency rises above 20 per cent results in a gray, matte deposit which in thick layers may crack and peel badly. There is, therefore, a range of current densities which will produce good plate. Certain metals such as copper and brass, when used as cathode exhibit a comparatively wide range; other metals such as nickel and iron a narrower one.

Changing the temperature of deposition shifts this range. For example, at room temperature with a given solution good deposits can be obtained on copper between 20 and 80 amperes per square foot (2.2 and 8.8 amperes per square decimeter), at 60° C., between 70 and 600 amperes per square foot (7.7 and 66 amperes per square decimeter).

It will be found that, although the range of current densities producing good deposits increases with the temperature, the current efficiencies of the deposition remain nearly the same. That is, good plate for decorative purposes will be obtained between 5 and 20 per cent current efficiency regardless of the temperature. If thick deposits are desired a current density and temperature combination to give about 13 per cent current efficiency will form a bright, smooth plate with the minimum tendency toward treeing. A detailed study of these conditions will be taken up in the more technical account of chromium plating in the second part of this bulletin.

If the bath contains other things in addition to the essential chromic acid and sulphate or its equivalent, unfavorable conditions will result. For example, the formation and accumulation of trivalent chromium leads to increased resistivity in the bath. It also greatly contracts the plating-range already described. Dissolved iron also increases the resistivity of the solution. Other effects are not yet fully known.

Bright chromium surfaces are obtained by plating on bright undercoatings. It is easier to obtain fine finishes by plating on a buffed undercoat of a metal like nickel than upon buffed copper. Dull chromium can, however, be buffed by using a special buffing compound although this procedure is generally uneconomical and unnecessary.

* Part 1 was published in our February issue. Complete copies of this publication can be obtained by writing for A Study of Chromium Plating, Engineering Research Bulletin No. 10, to the Department of Engineering Research, University of Michigan, Ann Arbor, Mich., Price, $1.

The necessity for control is very great in chromium plating. In best installations there will be found thermostatic temperature control, recording thermometers, accurate ammeters, good fume exhausters, and there will be some provision made for a periodic chemical analysis of the bath. There is, however, no great measure of uniformity in the quality and extent of the control methods at the present time.

CONCLUSIONS DRAWN FROM THE RESULTS OF RESEARCH

The problems in the electrodeposition of chromium from chromic-acid baths were studied by means of investigations along the following three general lines:

I. The effect of bath composition, nature of anodes, and plating conditions on the cathode deposit.

II. The effects of bath composition, nature of anodes, and plating conditions on anode behavior.

III. The effects of bath composition, nature of anodes, and plating conditions on the ultimate, "equilibrium," bath composition.

In addition some miscellaneous studies dealing with control methods and with some properties of electrodeposited chromium were made in a fourth section of the research.

The work presented in the foregoing portions of this bulletin has led to the following general conclusions:

Factors Affecting the Nature of the Deposit.

1. Of the two essential components of a chromic-acid plating bath, namely, chromic acid and sulphate ion, the concentration of the former may be varied over a wide range, but the concentration of the latter must be kept within very narrow limits.

2. The relative sulphate concentration expressed as the ratio by weight of hexavalent chromium to sulphate ion, $\frac{Cr^{VI}}{SO_4}$, must be maintained between 40 and 60.

3. For most favorable results, even with the above specified $\frac{Cr^{VI}}{SO_4}$ ratio, the chromic-acid concentration should not be allowed to drop below 150 grams per liter. From the standpoint of throwing power and the extent of the bright-plating range, a concentration of about 350 grams per liter of chromic acid is somewhat advantageous. When other factors are considered, 250 grams per liter has been found commercially practicable. At 600 grams per liter a very narrow plating range results.

4. Trivalent chromium and iron in the amounts studied in the investigation, do not markedly affect the yield of chromium obtained at a given current density. Their presence does, however, greatly contract the range of current densities at which bright deposits can be obtained. It is believed that trivalent chromium has a much greater effect in this direction than has iron.

5. A low plating temperature, 15° C. or less, has a tendency, especially in the case of thin plates, to favor the deposition of a brown slime together with the metal. It is very difficult to obtain bright, shiny deposits at 15° C. from a solution which functions normally at temperatures above 25° C.

6. Too low or too high a cathode current density at a given temperature will result in milky or gray matte deposits respectively. For a given bath such a combination of cathode current density and temperature which results in a cathode current efficiency of 13 per cent gives the best deposits. For example, in a solution containing 250 grams per liter of chromic acid and 2.6 grams per liter of sulphate, at 45° C. (113°F.) a current density of 10 amperes per square decimeter (93 amperes per square foot) will produce good deposits. At any temperature, the current efficiency is a function of the logarithm of the current density.

7. The nature of the anode has no direct effect upon the cathode deposit. It may affect the composition of the bath which in turn can alter the characteristics of the deposit.

Factors Affecting the Anode Behavior.

1. A high sulphate concentration in the bath is conducive to a high rate of anode corrosion.

2. The most important determining factor in anode corrosion is the inherent chemical character of the anode material. It has been found by other investigators that iron or steel must be free from alloys such as nickel or chromium to be most resistant to corrosion as anodes.

3. Anodes tend to dissolve or corrode more rapidly at high temperatures than at low.

4. In the case of iron and steel anodes, very low anode current densities, below 2.0 amperes per square decimeter (18 amperes per square foot) tend to increase the rate of corrosion markedly.

Factors Affecting the Equilibrium Bath Composition.

1. With fixed solution composition, anodes, and plating conditions such as current density and temperature, the trivalent chromium concentration of a chromic-acid plating bath will reach equilibrium. Naturally, in order to maintain every other factor constant, chromic acid and water must be added to the bath from time to time in order to replace the metal deposited out and the portion of the bath lost as spray or gas.

2. A high sulphate concentration of the bath favors a high equilibrium concentration of trivalent chromium.

3. The inherent nature of the anode material has probably a greater effect than has any other factor upon the magnitude of the equilibrium trivalent chromium concentration. This magnitude in turn is dependent upon the magnitude of the oxygen overvoltage of that metal or of its oxide. For example, anodes of lead, platinum, and iron are efficient in that order in keeping down the trivalent chromium concentration.

4. A high temperature favors a higher equilibrium trivalent chromium concentration, other things being equal.

5. A low anode current density, especially in the case of iron or steel anodes, causes a low equilibrium trivalent chromium concentration.

6. The equilibrium concentration of trivalent chromium is markedly higher in a bath in which electrolysis is very frequently interrupted than in one electrolyzed continuously.

Miscellaneous Conclusions.

1. Sulphate analyses are best carried out in acetate solutions rather than in chloride solutions.

2. Iron can not be satisfactorily removed from chromic-acid baths by any method known at the present time.

3. Lead chromate can readily be removed from lead anodes by means of a saturated solution of sodium chloride acidulated with hydrochloric acid.

4. Heavy chromium deposits show the presence of voids and cracks.

Resistance Wire

Q.—Please give me the name of a firm that sells a good grade of resistance wire for use in rheostats.

A.—We would suggest that you try to get the resistance wire from the same concern that made the rheostats in which it is to be used. If you send them the number of the instrument they will be able to supply the proper resistance coils for your particular rheostats. It is inadvisable for you to wind the coils yourself if you are not well experienced in the work.—OLIVER J. SIZELOVE.

Methods of Silver Plating

Solutions and Control Methods; Analysis, Attention to Temperature and Current Density; Distribution of Current; Agitation and Filtration of Solution.

By F. C. MESLE,
Oneida Community, Oneida, N. Y.

FROM THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, NOVEMBER, 1928

IT seems there has been no radical change in basic silver plating practice in many years. What improvements have been made have been in the nature of refinements of the basic practice, such as careful analytical control of the solution, careful attention to temperature and current density, distribution of current over cathode surface, agitation and filtration of the solutions.

The solution will vary in composition, depending upon the article to be plated, thickness of deposit, and nature of finish. In general we recommend the double silver cyanide solution in preference to sodium cyanide when there is little difference in the price, and in some special cases at any price. When a thin deposit is required, such as on reflectors, and a large production with a minimum of finishing labor, a solution with from ½ to one ounce of silver per gallon and from four to six ounces of free cyanide should be used, with carbon disulphite as a brightener. This solution is suggested because with a large production there would be considerable loss of solution through drippage; hence the more silver in solution the greater the loss.

But for general plating where heavy, smooth deposits are required, such as for nickel silver table ware and where speed is necessary, we would recommend a silver solution as follows:

Silver, 3 to 4 ounces per gal.
Free cyanide, 4 to 6 ounces per gal.
Potassium carbonate, 4 to 8 ounces.
Carbon disulphite as a brightener, added in usual way to the above solution.

I think it is important that the bright solution should be of uniform strength. It has been common practice to put disulphite of carbon in the bottom of a bottle and add silver solution or cyanide solution and shake up at intervals during a week or two and then draw off the solution and use as a brightener. The chances are that no two batches made up in this manner would be the same.

The following method is suggested as more satisfactory. To one gallon of water add four ounces of cyanide and seven c.c. carbon disulphite. Shake until carbon is all taken up in solution. If put in a shaking machine at 150 shakes per minute, it will take about five hours. This gives a brightener of uniform strength and you can be sure that one lot is the same as the next.

The above solution will produce a uniformly bright deposit at a current density of from ten to fifteen amperes per sq. foot of cathode surface, provided the cathode is agitated and the temperature of the bath is about seventy degrees Fahrenheit.

Current density, or amperes per square foot of cathode surface. This term is very indefinite because there are so many factors that cause an uneven distribution of the current over the surface of the cathode.

A flat cathode twelve by twelve is hung in the vat parallel with the anodes at a current of twenty amperes. We would say a current density of twenty is being used, but the current density at the edges may be forty, and in the center only ten. If the cathode is set at an angle, the edges will receive more and more of the total current until the position of the cathode is set at right angles to anode. Likewise any change in the shape of the cathode will change the distribution of the current over the cathode. The solution, agitation and temperature all affect the distribution of the current.

Let us say that in thirty dozen teaspoons we have a total surface area of twenty square feet, and I tell you that I use a current density of fifteen amperes or 300 amperes on thirty dozen teas. From this it could be assumed that in the above mentioned solution at a certain temperature a c. d. of fifteen can be used satisfactorily, but this average current density of fifteen can be used only when the maximum current density does not exceed thirty. And this maximum current is controlled by the arrangement of anode to cathode. If the spoons could be racked or wired so that 100 per cent uniformity of current was spread over the entire surface of the lot, then a c. d. of thirty amperes could be used or 600 amperes per thirty dozen of teaspoons.

Let us illustrate the other extreme. Suppose we put these thirty dozen of teaspoons in circular or (bird cage) racks, one spoon back of the other with one side of the spoon towards the anode and the other side of the spoon toward the center of the rack, and use an average c. d. of fifteen amperes. As this rack revolves in the vat the c. d. on the quarter of the rack nearest the anode would be from twenty to thirty amperes. Due to the position of the spoons in the rack the edge of the spoons towards the anode would receive a current density of from forty to sixty. This is twice the maximum current that can be used and do good plating in this solution. Therefore, to plate teaspoons in a circular rack the current density must be seven and a half or less to keep the maximum under thirty amperes per square foot.

Because of the great variation in current over the surface of the spoons when racked this way, it is impossible to have a deposit of uniform color or thickness. (More on thickness later.)

I have gone to some detail to explain what I assume is common knowledge because just this year a good friend of mine who has long been in the silver plating game, suggested that it was a good idea to plate knives with the blades down because the plate was always heavier on the part of the knife that was lower in the vat, but this is only true when the anode is lower in the vat than the cathode. Do ends of anodes furnish more current?

Yes, but only because greater volume of solution that is available to conduct the current from the anode.

If a dead white deposit is desired such as will help to cover emery lines on knife blades or other slight surface defects or the crystal structure of any base metal, and in finishing the work is to be burnished, we suggest a solution of

Silver	3 to 4 ozs. per gal.
Free potassium cyanide	1 to 3 ozs. per gal.
Potassium carbonate	4 to 8 ozs. per gal.

No disulphite of carbon and about one-half the cur-

rent density suggested above, with similar agitation and temperature.

Careful control of solution is important for uniform results. A silver solution in standard condition can be depended upon to produce the same kind of work day in and day out. Therefore, keep your solution under control. When the temperature of a solution cannot conveniently be controlled it will be found necessary to vary the current density with the change in temperature if the deposit is to be uniform.

Effect of change in temperature on possible current density

Temperature	55	63	70	78	85
Ave. c. d.	5	7.5	10	12.5	15
Cath. surface	20′	20′	20′	20′	20′
Amp.	100	150	200	250	300

For instance, if a deposit of the desired color (which I think indicates crystal structure) is produced in a solution at a temperature, say 55 degrees Fahrenheit, and at a current density of five, should the temperature be raised to about 80 degrees Fahrenheit, a current density of 13 would be required to produce the same color of deposit. As pointed out by Dr. Blum, an increase in temperature of the solution increases the size of the crystal structure of the deposited metal (hence the color changes in silver makes the deposit whiter in color). But I think this is only true when the current density is the same in the low and higher temperature solution. If, however, the current is increased with the temperature in about the ratio suggested above, there will be little change in the size of the crystal structure of the deposit. In other words, to get uniform results out of a solution the current used should be as high as possible and yet not burn the deposit.

In a warm solution of 90 degrees Fahrenheit or above, due to the poorer throwing power, it is very difficult to produce uniform color on pieces that have deep recesses or cathode surface of irregular shape. The recesses will have a white deposit and the ends or surface near the anode will be bright.

In silver plating tableware it is important that there be a fairly uniform deposit of silver comparing one piece with another. If teaspoons are to have ten ounces per gross, it means that each spoon should have 1.4 dwt. of silver. Of course 100 per cent uniformity is difficult, if not impossible, but good practice demands that this difference be reduced to a minimum.

The circular rack that revolves in the solution no doubt gives best results so far as uniform deposit between pieces is concerned, but it has one serious drawback in that on this type of rack the anodes are all on one side, with the result that one side of the spoon receives less than half as much silver as the other, and frequently the thin deposit is on that part of the spoon that receives the most wear.

The thickness of the deposit is in direct proportion to the time and the current density. At 40 minutes plating time and a current density of 15, if we change the c. d. to read .0010 we have approximately the thickness of the deposit of silver, or at the above time and current the silver deposit will average .0015 inches thick. At this average thickness when there is a variation in the distribution of current as suggested above when a certain type of circular rack is used, it means that the thickness of the deposit will vary from .0003 to .003, or the deposit will be ten times thicker in one part of the spoon than on another. Even this is not objectional provided the thin deposit is at the place of least wear, and the thickest at the place of most wear. But when racked as mentioned above the back of bowl receives only about half the average thickness or .00075" at the point of most year.

If we use this same type of rack and place the spoons so that the back of the spoon will be toward the anode we may still have the same variation in current and therefore thickness, but the thicker plate would be at the point of greatest wear, but we could only put about one-third as many spoons in a rack with the same current problems characteristic of round racks.

A 40 minutes' deposit at a c. d. of 15 amperes will produce a deposit .0016 in. thick.

A 80 minutes' deposit at c. d. of 7½ amperes will produce a deposit .0016 in. thick.

A 160 minutes' deposit at a c. d. of 3¾ amperes will produce a deposit .0016 in. thick.

So it is a problem of the silver plater to so arrange the area and size of his anodes to distribute the current evenly to each piece, and then unevenly over the surface of each piece so that the silver deposit will be thickest on that part of the spoon that receives the most wear when in use.

At first thought it might be assumed that the surface area and size of the anode are the same, but they are not. If we take a silver anode 12" x 6" x ⅛", in this case the surface area and size would be the same.

If this same anode is corrugated, the size of the anode would be reduced but the active surface area would remain the same. Now, if we cut this same anode into strips, some two inches wide and some four inches wide, we could reduce the size or enlarge it with about the same surface area of the anode, or we could so arrange these strips that the center of the anode would have more surface area than elsewhere. By careful study of our needs we can put the thick deposit of silver where it is most needed, or direct the flow of current as we desire, when it is important enough to justify the additional care and expense.

Of course agitation is important but has its limitations, especially when we are working toward control of distribution of the silver. Agitation makes for poorer throwing power. It seems that every factor that makes possible faster plating also tends to reduce throwing power.

To plate a thick smooth silver deposit the solution must be clean and free from small particles of metal that float from the anodes. To have the anodes enclosed in cloth bags and frequent filtering of solutions is a help in this direction. (Applause.)

Drawings on the following page indicate the approximate thickness of the silver deposit over the surface of a teaspoon in inches. The total deposit of silver—14 ounces per gross or 48 grains per spoon.

#AA was plated in a double row, rack, back of bowl toward the anode, about three inches between rows, and one-fourth inch between spoons. The rack was of light construction and the spoon held at bowl very close to handle, with very little shading of the spoon by the rack.

This spoon had a sectional plate back of the bowl that was visible on the finished spoon.

#A is a spoon of outside manufacture. I do not know how it was plated, but analysis indicates about as follows: That this spoon was plated the same as #AA except that the rack was of heavier construction. The spoon was held in the rack further up on the bowl, these two factors causing more shading of the bowl near the handle. The rows were closer together and the spoons nearer together. This difference in rack would explain why #A is thinner in the bowl and on back edge of bowl.

This spoon had a light sectional plate on back of bowl that was not visible on the finished spoon.

#B. Is a spoon of outside manufacture and analysis indicates plating conditions about as follows: Plated in a single row around a circular rack, with spoons very close together—back edge of one side of bowl toward anode, and the other side toward the center of the rack,

two-thirds of back of bowl shaded by the bowl of the next spoon. No sectional plate on this spoon.

#C. Analysis indicates this spoon was plated in a double row rack, the spoons set at an angle about the same as #B, so that the back edge of spoon is toward the anode and the other side of spoon toward the center of the rack. The rows were fairly close together but the spoons much further apart than in #B, no sectional plate on back of bowl.

#D. Plated in a double row, rows two inches apart, spoons about 1 inch, with edge of one side of bowl toward anode and the other edge of bowl toward the center of rack. Little or no shading—no sectional plate on back of bowl.

The drawings should help explain the effect of different wiring or racking methods in the distribution of the current over the surface of a cathode.

The total surface area on the different spoons shown in the drawings were not the same. I would estimate the area of #B and #C to be about 20 per cent more than on the other spoons, the other three spoons were about the same surface area.

We have attempted to show, by these drawings, the difference in results produced by just a difference in racking methods, of a single and double row of spoons in a rack; two, three and four "deck" racks would produce still different results. A straight or curved "deck," the distance the rows are apart on the different "decks" of the same rack are all important factors that affect the distribution of the deposit over the spoon—and the deposit on one spoon in relation to the other, to say nothing about the different methods of wiring spoons for plating.

potassium cyanide than is possible from a sodium cyanide. I am not prepared to say why.

Dr. Blum: I would like to ask whether you estimated the amount of brightener, when you have any method of controlling the concentration. In other words, how many parts of carbon disulphide approximately are in the solution, or have you anything to control it?

Mr. Mesle: I haven't any means of controlling it yet. We are just governed by the appearance of the work.

Dr. Blum: May I ask this question: about how much—your stock solution is about one part in five hundred of carbon disulphide, how much would you add to a hundred gallons of solution in the beginning if making up entirely new baths?

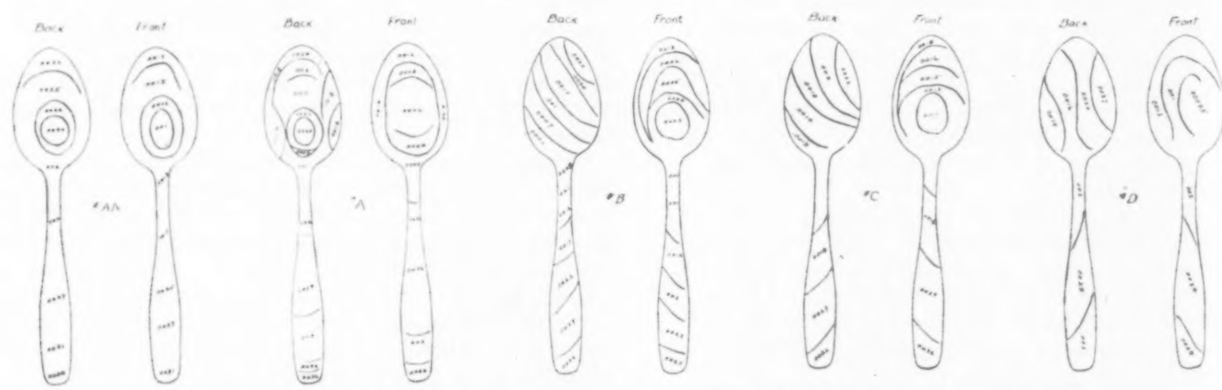
Mr. Mesle: From four to six ounces per hundred gallons; it is very small. I would estimate it is less than one part carbon disulphite to a million parts plating solution.

Question: How often do you add it to your tank?

Mr. Mesle: Daily, sometimes hourly—not quite that often, but whenever it is required from the appearance of the work.

Member: I would like to ask you to explain a little bit more to us about what you term a better plate from the cyanide potassium versus the sodium.

Mr. Mesle: For instance, we take knife plating and when sodium cyanide is used an attempt is made to make a white deposit. That deposit will be more difficult to finish, will show the poishing lines, emery lines, much more than when a desposit under exactly the same conditions is produced in a potassium bath. The deposit seems to burnish up better, cover over the slight basis



Drawings Showing Thickness of Silver Deposits on Various Parts of the Surfaces of Spoons

It is not unusual to find spoons or any flatware pieces with from three to four times the thickness of silver on the back of the handle than on the back of the bowl, and vice versa, which suggests that there is lots of opportunity for improvement.

Chairman Smith: Gentlemen, you have heard this paper by Mr. Mesle on silver plating. It is now open for discussion. I will allow each man who wants the floor a minute.

Mr. Wittig: In the formula he gave us for burnishing, I believe he said three to four ounces of silver metal per gallon, and one to three ounces of free cyanide. Is that right? (Assent.)

Mr. Pearson: Mr. Mesle stated that potassium salts had been preferred rather than sodium. What difference is there in the use?

Mr. Mesle: The difference, we find, of course there is quite a little discussion on that, but it is our experience that we can always get a much better dull deposit from a

defects. That is the main point. It lies down better, is easier to burnish and covers the polishing lines a lot better.

Question: Have you had experience with an overdose of carbon? May I ask what do you suggest as a cure for that sulphide solution when you have the overflow?

Mr. Mesle: Some years ago by mistake some bisulphite of carbon was put into our silver solutions. We did not know what had happened, but we could get no good work out of our solutions; we finally discovered that bisulphite of carbon was put into the vats. It was necessary to filter the solution and sponge up the bisulphite of carbon from the bottom of the vat. That is an extreme condition and when there is an overdose it is just a matter of a day or two before it gets back to normal. That was an extreme case. It happened a long while ago. I remember at that time we had to filter every vat we had in the room before we could get good work.

What Foremen Should Think About

How Two Large Metal Manufacturing Companies Teach Foremen to Rate Their Men

By L. A. HARTLEY
Director of Industrial Education, National Founders' Association

A PAPER READ AT THE MEETING OF THE NATIONAL FOUNDERS ASSOCIATION, NEW YORK, NOVEMBER 21, 1928

ANY intelligent method of discharging or laying off employes, like skillfully performed surgical amputations, takes account of the general health of the body and the plan for recuperation. In industry, this requires consideration of the entire personnel in relation to production. The methods followed in one factory* illustrate the intimate connection of discharges and lay offs with other problems of plant economy.

SIX RULES OF GOOD WORK

This large concern has established six definite rules of conduct for all employes regardless of the nature of their duties. The organization consists of two large plants employing several thousand men and women and manufacturing different products of highly competitive nature. These rules of conduct apply equally to the general manager and the most ordinary laborer. Furthermore, they have been selected because their observance assures personal success in all phases of individual life as well as assuring success on the job and in the business.

These rules have been tested for a considerable period of time and a careful check has been made of the effect of their observance on the job and in outside relationships; and there is reason to believe that the aims of this management are being achieved. Men who observe these directions do become better on their jobs regardless of the job. They also succeed better in their personal affairs, and consequently their home life is happier.

The six rules are as follows:

1. Follow instructions willingly.
2. Be clean and orderly.
3. Take good care of property and materials.
4. Work well from whistle to whistle.
5. Work every day you can and tell your foreman when you cannot.
6. Work well with others.

These are called "the six laws of good work." In this big organization, every employe is expected to know them and continually to study their application. Group and individual instruction is organized with this definite objective. An illustrated booklet with full explanations of the Why's as well as the How's of these requirements is given to every employe.

A TWO-SIDED PROGRAM

The two-sidedness of the program is emphasized. The legends under two appropriate cuts in this booklet are "notify your foreman if you can't come to work—and your foreman will hold your job for you until you are able to work." The common objective of all is stressed. The legend under another picture reads, "We are all working for the same boss, and that boss is the customer."

It is not always the man who knows best how to use the best materials who is most desired on the job. The good carpenter is one who not only knows how to make the best use of good materials, but who also knows where to make use of the less finished lumber which will serve equally well in places not requiring the better finish.

A printed form was prepared which was in reality a form for recording the observance of the six laws by each individual. At the top of the card was a place for the date and the name, department, and job of an employe. Then followed the laws, and opposite each were two squares in which the employe's foreman was to place "yes" or "no," according to whether the employe did or did not observe the particular law. At the bottom was a place for the signature.

At one time, when a lay-off had to be made the foremen were called into the office in groups of from fifteen to twenty and the purpose of the form was carefully explained. Then each member of each group was encouraged to ask any questions he desired. Each foreman was given to understand that men would be retained in accordance with the foreman's report of the men's observance of these laws, and that it was the purpose of the company to avoid if possible laying off any man who was reported as having an excellent record on this basis.

PLAYING FAVORITES MADE DIFFICULT

Then came the interesting part of the program. When the records began coming in, foremen were called in to discuss very intimate details of their conclusions. Why was John Smith considered as not following instructions willingly? The foreman was asked to cite examples of John Smith's having violated the "first law of good work." What were the circumstances of James Brown's violating the second law? And so on throughout all of the report. Very early in this experience, some foreman asked that they be given an opportunity to revise their records. Playing favorites was soon eliminated by all in an honest endeavor to check up on the application in industrial economy of these principles. The effect of all this upon production is obvious.

Then came the real test of this program, for some men had to be laid off whose records were good. The management stated that this was the hardest thing they ever had to do in connection with managing a plant. But the case was settled under the sixth law which refers to cooperation. It will be remembered that the definition of the standard of good work applied to manager and foreman as well as laborer.

A DOUBLE ACTION EMPLOYMENT DEPARTMENT

If working well with others meant anything, it meant being as helpful as possible to the other fellow at times when he needed help. The company could not economically use these good men just then, but they could put their employment department to work to get them jobs elsewhere, and this they did.

An employment department was actually made to work both ways. Every man who had observed all six laws reasonably well was either kept on the job or a job was found for him with some other company, and when men

*You and Your Work, p. 3. Frigidaire Corporation, Dayton, Ohio.

were taken on again employes who had been laid off were re-employed in accordance with their record.

This program is being duplicated by the Ohio Brass Company,* Mansfield, Ohio. This organization did not announce the same laws. In this case, seven laws, were set forth as follows:

1. Does he do good work?
2. Is he dependable?
3. Is he careful?
4. Is he clean and orderly?
5. Is he punctual and industrious?
6. Does he follow instructions willingly?
7. Is he agreeable?

In the case of the Ohio Brass Company, seven other questions were asked with a view to stimulating the interest of the foreman in the personal welfare of the men and women in the plant. These latter questions were stressed with the result that every foreman in the plant has become much better acquainted with his men. These additional questions are as follows:

1. Is he single? or married?
2. How many dependents?
3. Does he own his home?
4. Is he buying a home?
5. Has he group insurance?
6. Is he in saving plan?
7. Has he ever made any suggestions for improvements?

FUNDAMENTALS OF INDUSTRIAL ECONOMY

These plants have achieved remarkable savings in production. They have noteworthy records in maintenance of equipment; their conservation of materials is unusual; their scrap or unusable product is exceedingly low; the plants are kept clean at little extra expenditure; orderliness is apparent; and accident records are extremely low. In addition to all this, there is an unmistakable atmosphere of happiness prevailing throughout the organizations. These rules are the fundamental principles of industrial economy in these nationally known manufacturing institutions. Their intelligent application by and to all employes carries the interest in each other's affairs beyond the plant and does it without paternalism.

*Our Work. The Ohio Brass Company, Mansfield, Ohio.

Foundrymen's Convention to Feature Metals

Gathering at Stevens Hotel, Chicago, April 8 to 11, Will Bring Out Many Papers and Discussions of This Phase of the Casting Industry

THE American Foundrymen's Association and its various committees have made considerable progress in preparation for the 1929 annual convention, which is to take place at the Stevens Hotel, Chicago, Ill., April 8 to 11, inclusive. This will be the thirty-third annual convention, and, according to all present indications, it will equal, if not exceed, all its predecessors. Especially in regard to the non-ferrous branches of the industry will there be a marked gain over past years. There are to be, according to Technical Secretary R. E. Kennedy, more sessions, more discussions and more activity in general on non-ferrous foundry subjects than on any other single branch of the foundry industry. It is expected that the attendance of brass and aluminum foundrymen will exceed all former years, and that the Program Committee's activities in this direction will bring to the convention a greater number of papers on this type of work than ever before.

NON-FERROUS COSTS

On Tuesday, April 9, there will be a special session on non-ferrous foundry costs and the group method of handling uniform cost procedure. This will take the form of a luncheon to which all non-ferrous foundrymen are invited.

There will be a symposium on foreman training on Wednesday, April 10 at 2 p. m. This subject is becoming increasingly important to all foundrymen.

PAPERS

In the tentative schedule of papers to be presented at the various sessions of the convention, the following are of particular interest to metal foundrymen:

Tuesday, April 9

10 a.m.: **Practical Aspects of the Value of Foundry Cost Methods,** by E. T. Runge, Cleveland, Ohio.

12:30 p.m.: **Round Table Luncheon and Meeting:** Uniform Non-ferrous Cost Methods.

Wednesday, April 10

10 a.m.: Non-ferrous Foundry Practice.

Some Practical Problems in the Brass Foundry, by H. J. Roast, National Bronze Company, Ltd., Montreal.

An Open-Flame Hearth-Type Furnace for Melting Aluminum and Its Alloys, by R. J. Anderson, G. E. Hughes and M. B. Anderson, Fairmont Manufacturing Company, Fairmont, West Va.

Electric Arc Furnaces in General Jobbing Brass Foundry, by J. B. Meier, F. and H. Foundry Company, Newark, N. J.

Report of Chairman of Division of Non-Ferrous Foundry Practice.

PRIZES FOR 1928 PAPERS

Three of the papers presented at the 1928 convention of the American Foundrymen's Association were awarded prizes of $100 each. For the purpose of judging the papers, all were divided into six groups, namely, non-ferrous, malleable, steel, gray iron, sand control, and general foundry practice. Among the three winners was **"The Effects of Lead on the Properties of a Complex Brass,"** by O. W. Ellis. Mr. Ellis was metallurgical engineer in the research department of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. He is now with the Ontario Research Foundation, Toronto, Can.

THE METAL INDUSTRY

With Which Are Incorporated

The Aluminum World, Copper and Brass, The Brass Founder and Finisher, The Electro-Platers' Review

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Edition this Month, 6,500 Copies. Buyer's Guide, Advertising Page 89

Editorial

Twenty Cent Copper

COPPER is now selling for 19½c. per pound. A few months ago it was selling for less than 15 cents. Has the metal increased 19½c. in value during that short time?

It has not. An overwhelming demand has sprung up which, together with the small reserves on hand, has made it impossible to supply the users at the old prices. Copper has risen only a quarter of a cent at a time, but in astonishingly short intervals between rises. Buyers are now bidding against each other for metal and no one knows where the price of copper will rest.

Copper suffered several hard years, together with other metals, but was perhaps harder hit than any other. Then copper producers put their house in order by cutting costs of production and organizing to control, within reason, output and stocks of refined copper. The result has been up to the last few months, a very gradual but steady rise, during which time the leading copper producers made good profits and even the higher cost producers managed to get along.

Then copper passed the sixteen-cent level, which allowed everyone in the copper mining industry to produce at a profit. Now with copper at 19½c. and ready to go higher at any time, it is only a question of months before every wild cat hole in the ground will pour ore into the market. To be sure refinery capacity may be limited and hard to expand, but if pressure is applied it will expand. It may take one year, two years or three years, but the industry will again be in a position to flood the world with copper. How long will it take before the price of copper reacts to this situation and drops again?

There is another evil connected with a runaway market. Metal products have to be sold in a competitive market; competitive not only with other similar products, but with other metals and other materials. If copper goes too high, these products cannot be sold and consumption of copper will be cut to just that extent. Trifling in amount? Perhaps it is, today. But we can remember not so long ago that the copper producers were struggling to sell their metal for any purpose and in any field no matter how small the consumption, knowing that every pound of copper sold helped to keep the wolf from the door.

According to Mr. Ryan, chairman of the Anaconda Company, the prospects are bright and the demand for copper is strong today. But what if building falls off? Or automobiles? A decline in these industries is never more than a year away. Electrical manufactures are the backbone of copper consumption, but not all of it. A decline of 10 per cent in consumption after a too great rise will mean a much sharper fall.

With copper at sixteen cents there was prosperity for the producers and a working margin for the consumers of the red metal. With copper at twenty cents or over the market may be seriously impaired, perhaps at an earlier date that the metal trades realize.

It is our opinion that restraint and good judgment are necessary now more than at almost any other time, to keep the market within bounds otherwise. It will not pay the copper producers to have two or three bonanza years if they are to be followed by slumps. Neither will it pay copper consumers to keep their inventories down to the bare shelves if it leads them into excited bidding for metals in emergencies. There is a middle ground with prosperity for both parties.

Taking Discounts

A CIRCULAR from the Artistic Lighting Equipment Association has come to our attention which should be placed in the hands of everyone manufacturing metal products. The language used in this circular is strong, but knowing conditions in the foundry and plating trades as we do, we believe that many of our readers will echo their sentiments. Witness for example the following:

"If the buyer places his order under the standard terms of the seller—say 2 per cent for cash in ten days or thirty days net—the buyer has no right legally or morally, to change these terms without the consent of the seller; neither has he any legal or moral right to take the 2 per cent discount after the discount date has passed."

The circular goes on to apply harsh names to the practice of taking discounts after the legitimate discount date.

We all know that by the process of what is known as "inching in," the custom has grown of taking discounts whether they are earned or not. Originally discounts were taken only on payment made within ten days. Then some clever buyer found that he could take a discount on the 10th of the following month for everything purchased during the previous month. Shortly after this came the practice of paying on the 15th for everything sold up to the 25th of the previous month. It was only a short step before such payments were made, not on the 10th or the 15th, but at the end of the month after the materials were bought. In the meantime, discounts continued to be taken.

It is needless to say that such practices are vicious and in the end defeat themselves. The seller, after one lesson, adds the 2 per cent to his price. The net result then, is an attempt to get a slightly higher price and bad feeling afterward.

A simple solution would be to set the terms clearly and then insist that they be lived up to. If a customer takes the discount without having earned it, bill him for the discount separately. It may mean disagreements, but it should be remembered that no one who is otherwise satisfied, will withdraw his account for the sake of 2 per cent which he has not earned.

The Precedence of Metals

JUST as antiquity is a virtue and a long line of ancestors is a credit to a family, so precedence seems to be considered of some importance, at least for historical purposes, among metals. Which metal came first? Which metals followed? These questions may not be hotly argued, but they are asked often enough to show that the desire to know is more than mere idle curiosity.

Some of the origins are lost in the haze before history was set down. We know that copper, gold and silver are mentioned in the earliest of written history. We have also a so-called Bronze Age. Knowing as we do that gold and silver are often associated with copper, but that in certain localities gold and silver occur separately, it is practically impossible to state which of the three came first. According to Stoughton and Butts in Engineering Metallurgy, the metals and alloys of primitive man were gold, silver, lead, tin, iron, bronze and mercury. To arrange these in correct order of discovery would be little more than guess work.

The modern metals, zinc, aluminum and nickel are known to belong to our times only, for the simple reason that their extraction is extremely difficult and beyond the equipment in the hands of primitive man. The temperatures were high or the tendency to oxidation so great as to place these metals beyond the reach of our early ancestors.

Reverting to guess work we might say that probably copper in the form of bronze with zinc and tin as impurities came first. Perhaps, gold and silver followed shortly afterward or came at about the same time. Lead, tin and mercury are very early metals, and iron, to which an "age" has been devoted, followed later.

Archeological discoverers seem to find the red and yellow metals more than the others. According to newspaper reports, a recent find is the discovery of an altar dating back to 1600 B.C., by the University of Pennsylvania Museum Expedition in Palestine. Gold and bronze were there, but no other metals are mentioned.

New Metallizing Process

A FUROR has been created in the public press by a process for metallizing non-metallic materials. A London company is said to have a new method of metallizing or electroplating non-metallic materials, such as wood, porcelain, paper and cloth. No details have been divulged, but the merits of the process are said to be such as to have induced leading members of the British financial and political circles to join the board of directors of the controlling company.

It is hardly necessary to point out that electrodeposition of metal on non-metallics is not new. We have many times published methods of accomplishing this feat. The art of metallizing plaster, wood, leather and even such fragile things as flowers has been practiced for many years. Presumably, however, the new method is much finer than the older processes. According to the daily press, samples of metal-coated products were shown which were astounding in their properties.

No authoritative opinion can be expressed at this time, important as this advance may be, because no technical details have been given out. It is not at all unlikely that improved metals of plating have been developed, getting a much finer, smoother and perhaps stronger plate on non-metallics. It should be borne in mind, however, successful as this or other processes may be, that the art of plating on non-metallic materials is not new in principle. The chances are that any new process may be new in details rather than altogether revolutionary.

We will await with interest further information about such processes.

Chromium Plating Patents

FROM time to time questions are asked of us on chromium plating patents, and the patent situation in general. In order to clarify our position in the minds of our readers, we wish to state that we cannot advise on the patentability of a solution or on the freedom of any solution from patent litigation. Some authors, in our reading columns, have expressed opinions along these lines. These opinions, correct or not as they may be, it should be noted, are personal and do not reflect, in one direction or another, the position of THE METAL INDUSTRY.

Our only official statement is that the question of chromium patents cannot be answered while it is still in litigation. Certain decisions should be rendered in the near future which may go far to settle present differences of opinion, but no side can be taken by us at this date. The whole matter lies with the courts.

Foundrymen's Convention

THE convention of the American Foundrymen's Association, to be held this year in Chicago, April 8-11, at the Stevens' Hotel, will devote a considerable proportion of its activities to non-ferrous metals. The complete program, published on page 132 of this issue lists a number of papers on non-ferrous foundry work, a round table luncheon on cost methods and a symposium on foreman training.

Exhibits will be held, not as large or as extensive as those shown at the Philadelphia convention last year, but nevertheless interesting and useful.

Foundrymen interested in brass and aluminum will find it decidedly worth their while to attend these meetings.

Engineering Index Service

WE are informed by the Public Library of Newark, N. J., of the Engineering Index Service which issues, as soon as they are published, an Index on cards of 1,700 journals in all languages. This journal is among those fully indexed and is to be found in the public libraries of Newark, Cleveland, Bridgeport, Baltimore and the John Crerar library in Chicago. This index should be invaluable to engineers and metallurgists as it enables them to get track quickly of information on any subject covered in this enormous number of journals. Most of these libraries, like the Public Library of Newark, also answer inquiries by mail and telephone.

Correspondence and Discussion

"Worth More Money"

To the Editor of The Metal Industry:

I am enclosing my money for a renewal of my subscription, and I want to thank you very much for sending January's edition as I have been very glad to receive it. As I never knew you raised your rates until recently I received your notification. However, I think it is more than worth its money.

Sackville, N. B., Canada, March 1, 1929. R. E. FRIDER.

Casting Thin Bronze Plates

To the Editor of The Metal Industry:

I have noted with interest Mr. Reardon's article on page 3 of your January, 1929, issue, entitled "Casting Thin Bronze Plates." Some years ago I was engaged at a foundry where we cast a number of slabs 3/4 in. thick, 10 in. wide and 3 ft. long. We also cast some thin plates for a memorial. I am enclosing a sketch showing how these were cast and I believe that such a method would relieve the trouble your correspondent has had. I am merely suggesting this for what it is worth and do not make bold to question Mr. Reardon's authority, which I know he possesses in foundry matters.

Beloit, Wisconsin, February 25, 1929. CHARLES T. WITTICK.

To the Editor of The Metal Industry:

I have looked over Mr. Wittick's suggestion in regard to casting thin bronze plates and find his method very good for sand casting. However, the method I suggested in the original article was for casting in iron molds such as are used for casting slabs that are to be rolled. Sand casting is not suitable for rolling mill work, due to the cost as well as to the grain of the metal. However, I appreciate the interest shown by Mr. Wittick.

WILLIAM J. REARDON.

Opportunities in Metals

To the Editor of The Metal Industry:

I was greatly interested in your editorial published in the February number, entitled "Work Ahead in Metals," and I agree with you that there are left, no end of opportunities.

Your mention of the unsolved problem of producing aluminum from common clay reminds me of how the late Charles Martin Hall received his inspiration for producing commercial metallic aluminum from bauxite.

When Hall, a mere youth, was a student at Oberlin College and attending a class in chemistry, his instructor, F. F. Jewett, remarked to the class that there was a great chance for a young man who could work out a practical process of making aluminum. At that time the light metal was a chemical curiosity.

Hall whispered to a fellow student that he was going to try, and now the world knows the results. I recently read in your publication that inventor Hall had left $10,000,000 to schools in the Far East.

There are still plenty of chances in this land of opportunity for those who have the brains and willingness to work.

New York, N. Y., February 15, 1929. SUBSCRIBER.

Technical Papers

Investigations on Electrodeposition of Silver, With Special Reference to The Use of Sodium Cyanide, by Edward B. Sanigar. Transactions of the Faraday Society of London, England. Volume XXIV, No. 91.

The following conclusions are drawn:

1. Good silver plating solutions can be made up from sodium salts instead of potassium salts. A suitable vat contains:

Silver nitrate	35.0 g./litre
Sodium cyanide	40.4 g./litre
100 per cent excess cyanide	
Silver carbonate	80.0 g./litre

This solution, which has an adequate conductivity (9.08 x 10 — 2 mhos. at 25° C), has been tested and gives good, satiny deposits when worked at current densities of 0.302 amp./sq.dm. and upwards.

2. Increasing carbonate content causes a softening in the silver deposited.

3. Increasing free cyanide content up to 200 per cent excess makes a silver deposit softener, after which value the type of deposit changes and also becomes harder. The amount of free cyanide present largely determines the hardness of the deposit.

4. Variation of current density has relatively little influence on the hardness of silver deposits, high values favoring soft deposits. Good deposits can be obtained using high current densities provided that suitable solution composition and agitation are used.

5. With pure salts good silver deposits can be obtained from solutions containing both sodium and potassium cyanides. However, with old solutions particularly, the two cyanides should not be used together indiscriminately, since troubles apparently arise from the use of impure salts.

Lead-Tin-Cadmium as a Substitute for Lead-Tin Wiping Solder. By Earle E. Schumacher and Edward J. Basch. Bell Telephone Laboratories, New York. Industrial and Engineering Chemistry, January 1929.

Data are presented which show that certain lead-tin-cadmium alloys may be advantageously substituted as solders for lead-tin alloys. Data are given showing the physical and chemical properties of these alloys.

1. The addition of cadmium makes possible the use of higher percentages of lead in satisfactory solders.

2. These lead-tin-cadmium wiping solders are generally cheaper than corresponding lead-tin solders.

3. A solder containing 68 per cent lead, 23 per cent tin, and 9 per cent cadmium is satisfactory as a substitute for standard 62 per cent lead, 38 per cent tin solder.

The Behavior of Solutions of Chromium Trioxide Upon Electrolysis, by D. T. Ewing, J. O. Hardesty and Te Hsia Kao. Bulletin No. 19. Michigan Engineering Experiment Station, East Lansing, Mich.

It is evident that these results show that the percentage of the current used to evolve hydrogen is very large and is a function of the current density and the temperature. It should also be stated that other factors such as concentration of the sulphate effect the amount of hydrogen set free. The concentration of the sulphate content is rather low in these experiments, less than two grams per liter, but sufficient to give a good color to the deposited chromium. Somewhat larger amounts would have decreased the amount of hydrogen evolved and increased the amount of chromium deposited. The rate at which the amount of hydrogen decreases with temperature is important. At 50° C. and a current density of 20.8 amperes per sq. dm. 87.3 per cent of the current is used to evolve hydrogen, while at 30° and the same current density, about 73.3 per cent of the current is used to set free hydrogen. It should also be noted that at 30° C. the yield of chromium was about 17.13 per cent and at 50° C it was only about 8.4 per cent. Having determined the temperature and the concentration of the chromic acid at which the process is to be operated, one can find the optimum amount of sulphate to be added and thereby improve the efficiency of the process, but even then the above values will not be greatly altered.

Powdered Fuel in Metallurgical Work, by W. O. Renkin of the Combustion Engineering Corporation, New York presented before the World Power Conference of London, England, 1928.

This paper deals largely with powdered coal in the iron and steel industry but touches upon its use in some nonferrous metal work, such as copper furnaces, galvanizing and tinning, sintering and annealing.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS { WILLIAM J. PETTIS, Rolling Mill — W. J. REARDON, Foundry — P. W. BLAIR, Mechanical — CHARLES H. PROCTOR, Plating — OLIVER J. SIZELOVE, Chemical

Battery Construction

Q.—Please give me some information concerning the double liquid battery. Why do they use the porcelain sieve in this type of battery? I wish to use a tank 5 by 18 by 24 inches, and would like to know how to construct this.

I would also like to have information on the potentials of different metals.

A.—We do not know the type of battery you refer to. You will find considerable data covering the construction of batteries in the "Scientific American Encyclopedia of Receipts, Notes and Queries," pages 27, 28 and 29; also in the appendix, page 5. The book is published by Munn and Company, New York. This work will be found in most public libraries. You might write to Munn and Company, as they may be able to give you information on some complete work covering battery construction.

Very little work has been done on the subject of metal potentials. You will, however, be able to gain some information from Blum and Hogaboom's book, "Principles of Electroplating and Electroforming," pages 294, 295 and 296. Creighton's "Electro-Chemical Potentials" gives considerable data.

These works can be found in public libraries.

C. H. P., Problem 3,821.

Bronze Powders

Q.—I am interested in information pertaining to bronze powders and bronzing liquids. Can you inform me where literature of this sort may be obtained or if you could furnish same? Has any of this matter been previously published by you? Any information you may favor me with will be greatly appreciated.

A.—We can hardy send you a lengthy report of the type you desire without going to considerable expense. Under the circumstances, however, it might not be worth your while to pay for it. You can get considerable information from "Painters', Gilders' and Varnishers' Companion," published by H. C. Baird and Company, 2 West 45th Street, New York City. It is also likely that Norman W. Henley Publishing Company, New York City, has published books on this subject.

C. H. P., Problem 3,822.

Coloring Steel

Q.—In your issue of February, 1929, on page 91, a question regarding the cleaning and coloring of steel is answered. We would like to have more complete information regarding the coloring of steel by such a process.

What we wish to accomplish is a method of making more attractive some of the machined parts which we manufacture.

A.—The formula that was published on page 91 of our February issue works best on the non-ferrous metals. The finish produced is an oxide of lead and the contrast between this oxide and the ferrous metals is not great.

If the work is of ferrous metals it must be polished or ball burnished very bright and lacquered to preserve the finish. It is not rust-proof and we do not believe that it would be satisfactory for your class of work if used directly on the machined steel parts. If these parts could be brass or copper plated first, better results would be obtained with the finish.

O. J. S., Problem 3,823.

Defective Cadmium Solution

Q.—I have been operating a cadmium plating solution consisting of 7 ozs. of sodium cyanide, 3 ozs. of cadmium oxide and 2 ozs. of caustic soda per gallon of solution. This solution has given fairly satisfactory work during this entire time but does not seem as efficient now as when I first began to use it. I find that it contains 6 per cent sodium carbonate and will appreciate your advice as to the removal of this material.

A.—We do not believe that the carbonate content of the bath is the cause of your trouble. It is possibly due to a deficiency in cyanide or a metal content that is too high.

Send a 2 or 3 oz. bottle of the solution for analysis and state if barrel or still solution is used and we will advise you further.

O. J. S., Problem 3,824.

Hard Spots in Castings

Q.—We have mailed you a carburetor casting which we are making in our foundry. These are machined in an automatic machine 6 at a time and our castings have been developing hard spots at various places, as you will notice from sample. Our iron analysis is satisfactory and in addition we use ferro-silicon in the ladle when pouring these castings.

Can you offer any suggestions that will aid us?

A.—As you claim your analysis to be satisfactory, the only way to soften your castings would be to heat in an oven and cool slowly. Heat to 550 degrees C., or 1025 degrees F. This will in no way injure the castings and if this will soften them, they should not be heated any higher. However, it may be necessary to heat to 800 degrees C., or 1475 degrees F., and hold at that temperature about one hour after they have been heated through. If you have a hign silicon and a low sulphur iron, 550 degrees should be sufficient. It is very easy to try the heat treatment. In the meantime, look to your molding sand and see that the molder is not using the sand too wet. Also, do not allow the mold to be dumped up too soon after pouring.

W. J. R., Problem 3,825.

Low Cyanide in Cadmium Bath

Q.—I am plating with cadmium in a mechanical barrel and am using a solution made up of the following:

Sodium cyanide	12 ozs.
Cadmium oxide	6 ozs.
Caustic potash	2 ozs.
Water	1 gal.

I have had some trouble in getting throwing power out of this solution and any information you can give me on this will be helpful, I am sure.

A.—Your solution is undoubtedly low in free cyanide. Make an addition of 2 ozs. sodium cyanide per gallon and if results are no better, send a 2 oz. sample for analysis.

Cadmium solutions as a rule increase in metal if all cadmium anodes are used, so that it is seldom necessary to add any cadmium salt to the solution. The addition of cyanide to the bath at stated intervals will be necessary; also additions of caustic soda. If an excess of caustic soda is used the deposit has a greyish black color.

The method of cleansing or preparing the work for cadmium plating is important also. The surface of the metal to be plated must be chemically clean and free from any oxide. Ferrous metals are usually acid pickeled or sand blasted.

O. J. S., Problem 3,826.

Pouring Temperature for Brass

Q.—What is the pouring temperature for an 80-10-10 brass alloy?

A.—The pouring temperature for an 80-10-10 mixture is about 1900° Fahrenheit.

Ed., Problem 3,827.

Refining Metals

Q.—We are interested in developing a process in our plant for removing copper and antimony from a mixture which is approximately 85 tin, 7½ antimony and 7½ copper. We are particularly interested in learning about the sweating process and will be greatly obliged if you will outline this for us. If a special furnace is needed, please state type and best means of getting it, that is, whether to buy or build one.

We would like to have the title of an authoritative book on this kind of work.

A.—To remove the copper and antimony from the mixture it will be necessary to construct a sweating furnace so arranged that you can control the heat, and constructed so the tin will sweat out and run to a receiving pot. When all the tin sweats out, add 2 per cent of sulphur and a small amount of rosin. Boil the metal by inserting a hickory pole, or use a mechanical agitation. Skim off the top, if any copper remains it will form in a sulphide and is removed by skimming. The residue can be analyzed and used in making babbitt metal.

Sweating furnaces are similar to smelting furnaces for drosses, except that they are run at a lower temperature. If you have no dross smelting furnaces in your plant you can have them built by one of the firms advertising furnaces in THE METAL INDUSTRY.

W. J. R., Problem 3,828.

Plating Tinned Steel

Q.—Could you advise us if a coating of pure tin or cold rolled strip steel makes a harder surface when applied than does an 80-20 mixture of solder? Is the scleroscope reading on pure tin higher than on 50-50 solder or 80-20 solder, and if so, how much?

Will a coating of 80-20 solder on cold roller strip steel spoil a plating solution of nickel or silver when put in a plating tank? In other words, if we tin a piece of steel which later has to be plated in either nickel or silver, will this coating of solder on the steel hurt the plating solution?

A.—A coating of pure tin is harder than a coating of 80-20 solder. The scleroscope hardness of pure tin is higher than that of 50-50 solder or 80-20 solder. The only figures we have been able to obtain are as follows:

Tin	8
Babbitt	4-9
Lead	2-5

Lead is insoluble in a nickel solution. Tin would not be a detriment because the metal is frequently added to nickel anodes to make them more reducible. The alloy of 80 tin, 20 lead, therefore, would not be a detrimental factor in nickel or silver solutions. Such basic alloy surfaces do, however, require more careful cleaning to produce adherent deposits of nickel or silver than ordinary brass, copper or bronze.

C. H. P., Problem 3,829.

Powdered Chromite

Q.—Please tell us what you can about powdered chromite, which our plating department has just asked our purchasing department to secure for it. Is this substance easily obtainable from chemical supply houses?

A.—You do not state for what purpose you require the powdered chromite. Chromite is a natural chromate of iron, the chemical formula is $FeCr_2O_4$. This contains 68% chromic oxide.

We are of the opinion that what you actually want is chromic oxide, Cr_2O_3. This is a bright green crystalline powder. It is insoluble in water and acids, and its uses are as polishes for chromium plating, paint, pigments and ceramics. You can purchase the material from the chemical supply houses, polishing supply people, etc., who advertise in THE METAL INDUSTRY.

C. H. P., Problem 3,830.

Sunlight on Plating Baths

Q.—We have just moved into a new factory and our solutions of various colors of gold and silver are close to windows and the rays of the sun. It appears to us that the solutions are not working as well as they did in our old factory, where they were subject to hardly any light whatever, being in a dark part of the factory. Can you give us any information regarding the effect of sunlight on solutions?

A.—Sunlight has no deteriorating influence on any type of plating solution. It is one of the myths of the trade of early days in the plating industry. At one time, when anything went wrong with a plating solution it was thought that the earth's magnetism was the cause of the trouble, so in many instances the tanks were placed in a direct line with the north and south magnetic poles. That was another myth.

If your plater is still influenced by the sunlight myth, then arrange to have dark green cloth shades placed on the windows to keep out the sunlight. There must be other reasons than sunlight which cause the solutions to give results not as good as in your old location.

C. H. P., Problem 3,831.

Stop-Off Varnishes

Q.—I am using stop-off paint for two-color work in a cold green solution. It is green lacquer, asphaltum and turpentine. This comes off after about ½ minute's immersion. Will you please recommend something better.

A.—One of the best stop-off varnishes can be prepared from Egyptian asphaltum dissolved in pure turpentine, which should be heated in a hot water or sand bath. A small amount of gum mastic still gives better results.

A resist called "Valdura," manufactured by the American Asphalt Paint Company, 844 Rush Street, Chicago, Ill., has withstood the action of a nearly boiling platinum solution for a greater length of time than any other resist, at least 10 minutes. Get a sample from the above concern, and try it out.

C. H. P., Problem 3,832.

Tripoli Composition

Q.—I would like to know the ingredients of tripoli polishing composition, used in plating and polishing shops. I believe that part of the mixture is tripoli, silica flour, stearic acid and certain greases. I would like to experiment with this material and will appreciate any information you can offer.

What sort of machine would you recommend for mixing this composition?

A.—There is very little printed data available on the production of metal polishes outside of the regular liquid polishes used for polishing by hand. For tripoli or cutting down compositions, the cutting factor is either tripoli or a mixture of tripoli, silica or pumice stone powder. The binder is stearic acid, although paraffin wax is frequently used with it to cheapen the combination. Tallow is the lubricating factor and is added as may be required to produce a soft tripoli; more tallow can be used in the winter than in the summer for the same degree of hardness. The majority of metal polish manufacturers have their own formulas.

We can only give you a basis to work upon: powdered tripoli or a combination mixture 10 lbs.; tallow ½ to 1 lb.; stearic acid 1½ to 2 lbs.; paraffin wax ½ lb.

The waxes and tallows should first be melted in an iron kettle, then the tripoli added as required. The combination must be thoroughly mixed; mechanical agitation should be used.

While the mixture is in the molten state, it is customary to pour it into molds of a desired shape made of cast iron. At least a dozen bars can be run per mold. It will be necessary for you to experiment to some extent to get the correct mixture, just as you would in making a hard candy or something like that. Cut and try until you get the compound you want.

C. H. P., Problem 3,833.

Melting Points of Metals

Q.—Will you kindly give us the melting points of the following metals in degrees Centigrade:

Copper, nickel, tin, antimony and solder consisting of 1 part tin and 1 part lead.

A.—The Centigrade melting points of these metals are as follows:

Copper, 1083°; nickel, 1425°; tin, 232°; antimony, 630°; solder (1 tin, 1 lead), 205°.

Ed., Problem 3,834.

Patents

A Review of Current Patents of Interest

1,698,010. January 8, 1929. **Production of Metallic Bodies by A Combined Casting and Pressing Process.** Hermann Barthel, Schweinfurt, Germany.

A device for manufacturing metallic bodies under pressure comprising, a mould, a vessel adapted to contain molten metal disposed below said mold, a plunger adapted to pass through said mold into said vessel and displace the molten metal from said vessel into the cavities of said mold.

1,698,197. January 8, 1929. **Casting Machine.** John A. Lentz, Phoenix, Ariz.

In a casting machine, the combination of a flask containing a mold chamber connected by a sprueway with a crucible cavity in said flask; a cap adapted to seal said crucible cavity; means for sealing said crucible cavity with said cap; means for providing gas under pressure in said sealed crucible cavity to force molten material from said crucible cavity into said mold chamber; a crucible in which the material to be cast is melted, said crucible being separate and distinct from said crucible cavity and adapted to empty its molten contents into said crucible cavity; and means for automatically causing said crucible cavity to empty its molten contents into said crucible cavity.

1,698,212. January 8, 1929. **Metallic Alloy.** Henry L. Coles and Joseph G. Donaldson, Hamilton, Ohio, assignors to Guardian Metals Company, Hamilton, Ohio, a Corporation of Delaware.

A metallic alloy having incorporated therein over 60 per cent of tungsten, and nickel from 10 to 25 per cent, said alloy being encased in a different metal having the characteristic of materially higher heat conductivity than the tungsten-nickel alloy.

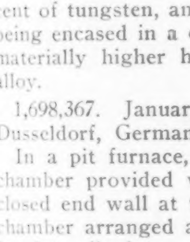
1,698,367. January 8, 1929. **Pit Furnace.** Gottfried Kehren, Dusseldorf, Germany.

In a pit furnace, the combination of an elongated heating chamber provided with a discharge outlet at one end and a closed end wall at the opposite end, an elongated combustion chamber arranged adjacent to said closed end wall and opening laterally into said heating chamber, a fuel inlet arranged in the end wall of said combustion chamber farthest from said closed end wall and discharging along the inner lateral wall of said combustion chamber toward said closed end wall of the heating chamber, the inwardly-presented lateral wall of said combustion chamber and the closed transverse end wall of said heating chamber being adapted and arranged to radiate heat to ingots disposed adjacent thereto and means for moving said ingots from the outlet end of said heating chamber toward the closed end thereof and into position adjacent to said combustion chamber.

1,698,647. January 8, 1929. **Purification of Magnesium and Its Alloys.** Gilbert Michel, Bagneux, France, assignor to Hart O. Berg, Paris, France.

The process of purification of magnesium or its alloys which comprises forming complexes with the oxychlorides and oxides found in the bath by mixing same with magnesium fluoride acting as a main purifier, without adding a chloride, and collecting the complexes at the surface of the bath.

1,699,592. January 22, 1929. **Process of Casting Metal.** August Kadow, Toledo, Ohio, assignor, by direct and mesne assignments, to The Vacuum Casting Company, Toledo, Ohio.



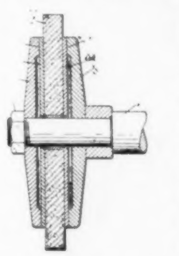
The process of casting liquid molten metal which comprises passing molten metal from a supply thereof into a mold through an inlet in the lower portion of the mold, separating the molten metal within the mold from said supply by closing the inlet, and thereafter moving the mold away from the supply while at least part of the metal within the mold is liquid.

1,699,665. January 22, 1929. **Brass Composition and Process of Producing the Same.** Otto Junker, Stolberg, Germany.

The process of manufacturing brass which consists in melting together the brass-forming metals comprising more than 63% in weight of copper with less than 37% in weight of zinc in the presence of soot and stirring the mixture when in molten condition so as to effect thorough deoxidization.

1,699,761. January 22, 1929. **Solder.** James Silberstein, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, a Corporation of Pennsylvania. A solder comprising an alloy of silver and lead in the proportion of .25% to 5% silver and the remainder lead and minor impurities and copper in the proportion of from .25% to 10% of the combined lead and silver content.

1,700,331. January 29, 1929. **Mounting for Abrasive Wheels or the Like.** George W. Perks, Akron, Ohio, assignor to The George W. Perks Company, Akron, Ohio.



A mounting for abrasive wheels, comprising a comparatively hard plate having preformed minute irregularities corresponding substantially to the minute irregularites characteristic of the surface of the wheel, and means to clamp the plate and wheel together so that the irregularities will mate and thereby securely retain the wheel in position when clamping pressure is applied.

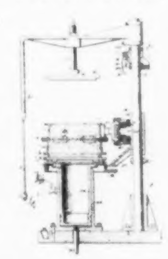
1,700,460. January 29, 1929. **Metallurgical Process.** John H. White, Cranford, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y.

The process of treating nickel, which comprises adding small amounts of vanadium and magnesium to the nickel while in its molten state, to render the nickel forgeable.

1,700,739. February 5, 1929. **Preparation for Cleaning Metal Preparatory to Painting.** James D. Klinger and Clete L. Boyle, Detroit, Mich.

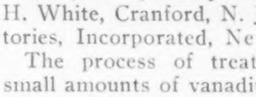
A composition of matter to be used for cleaning steel for painting consisting of a rust removing acid and the mono-ethyl ether of ethylene glycol.

1,701,598. February 12, 1929. **Molding Machine.** John Richard Wood, Hatboro, Pa., assignor to New Process Multi-Castings Company, a Corporation of New Jersey.



In a molding machine, a two-part flask, an element revolubly supporting said flask to permit the same to be rolled over, a pattern plate between the two flask parts slidably and pivotally connected to one of them, devices for simultaneously compressing molding sand in both of said flask parts against said pattern plate, and means for drawing said pattern.

1,701,722. February 12, 1929. **Metal-Sweating Furnace.** Tannie Lewin, University City, Mo.



In a metal-sweating furnace, a shell, a wall disposed horizontally within the shell, a trackway extending longitudinally of the shell and disposed over and spaced upwardly from said wall, a carrier comprising members adapted for travel on the trackway and apertured plates supported for movement relatively to the shell by said members for conveying through the shell the material being handled, means for subjecting the conveyed material to metal-sweating heat, and chambers upon said wall and beneath said trackway for receiving the fused metal flowing through said plates from the material being conveyed.

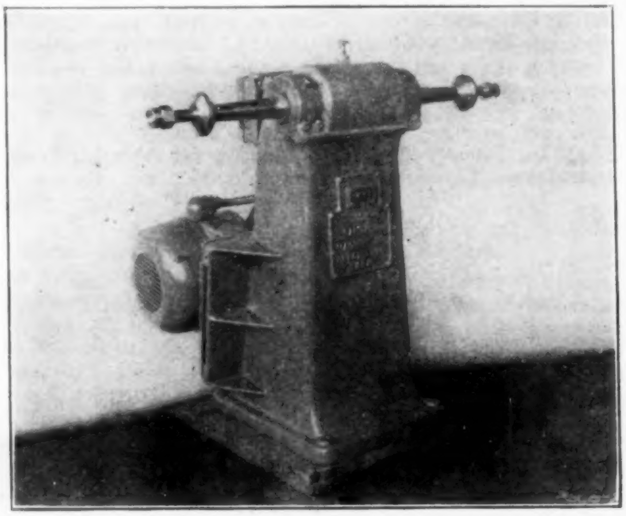
Equipment

New and Useful Devices, Machinery and Supplies of Interest

Single Spindle Polishing Lathe

The Gardner Machine Company, Beloit, Wis., has just placed on the market a new single spindle polishing lathe, to be known as the No. 3-CB, which is the latest addition to this company's well known line of machines. The makers claim that the new machine embodies a number of unique advantages, among which the following are uppermost:

Ability to obtain any desired spindle speed with A.C. motor



New Type Polishing Lathe

drive; the use of V-type multiple belt drive; great rigidity; compactness; and convenience of operation.

The spindle is driven through V-type multiple belts, by a motor mounted on a bracket cast integral with the machine base, making a very compact, floor-saving design. Adjustment for varying belt lengths is provided. In case of belt breakage, replacement can be made in a few minutes and without disturbing the bearing mounting on the spindle.

The motor regularly furnished with this lathe is of the enclosed, fan-cooled, ball bearing type, and can be supplied in 5, 7½ and 10 H.P. sizes. By using sheaves of proper diameter, any desired spindle speed may be obtained. This of great advantage where alternating current only is available or is preferred. The spindle is large—2¼ in. bearings and 1¼ in. arbor diameter, to take polishing wheels up to 3½ in. thick. A double-row Timken adjustable bearing is used in each end, mounted in a thoroughly dust proof cartridge housing which may be removed from the base without disturbing the bearing mounting on the spindle—the entire spindle assembly can be removed as a unit.

The semi-projecting type of base, giving a slight overhang of the spindle, provides ample clearance across front of machine.

This new lathe, it is stated, embodies all of the standard features which have always characterized Gardner construction. Safety spindle nuts, double-capped oil hole, handy push-button control station, convenient spindle locking device, and through-and-through massive, machine-tool design, insure long life with minimum attention, even under severest operating conditions, the makers state.

New Acid-Proof Cement

"U. S. Standard" is the trade name of a new acid-proof cement which has just been placed on the market by The U. S. Stoneware Company of 50 Church Street, New York, N. Y. The finished product represents the work of several years of intensive research and development, during which time every known brand on the market was analyzed and tested, the makers claim.

This cement is acid, alkali and corrosion proof against all acids, alkalies, chemicals and gases, weak or strong, hot or cold it is stated. The sole exception is hydrofluoric acid. The principal applications are for acid-proof tank linings, Gay-Lussac and Glover towers, acid-proof floors, acid concentrators, acid-proof fan casings, galvanizing and plating tank construction, acid-proof stacks, linings for acid gases and fumes, etc.

The silica content of "U. S. Standard" acid-proof cement is 70.07%. As a result of this high silica content the cement has high refractory properties. It is pulverized to a fine mesh. This allows the cement to set into a dense and tight body. A battery of special machines has been installed to keep the percentage of impurities to an irreducible minimum, according to the makers. Production has been centralized in Plant No. 3 of The U. S. Stoneware Company at Tallmadge, Ohio.

Salt Water Spray Testing Machines

A new type of apparatus for salt water spraying tests, consisting of a ¼ horsepower motor, bronze pump and fittings, nozzles, tank and filter, has been designed and placed on the market by the Industrial Filter and Pump Manufacturing Company, 361 Ontario Street, Chicago, Ill. The company, in describing this machine, states that the pump is fool proof and in every manner practical and sturdy. The tank supplied with the machine is made of tinned sheet copper and measures 18 by 35 inches, making it sufficiently large to test numerous pieces at the same time. Larger tanks are supplied upon order.

In connection with the apparatus, the makers state that it should be used in every plating plant where quality work is produced. The apparatus, they state, costs less to operate than units requiring compressed air circulating outfits and that it is suitable for 24, 48 or 72 hour continuous testing duty. The desirability of the salt spray test for determining the lasting qualities of metallic coatings has long been well known to the metallurgical industries.

Fight Plague with Spray Guns

A new and unique use for DeVilbiss spray-painting equipment is revealed in an order for 30 DeVilbiss spray systems given by the Health Department of Rio de Janeiro, the DeVilbiss Company, Toledo, Ohio, reports. These 30 DeVilbiss outfits are said to be the most efficient aid the health authorities of the South American metropolis have found in their fight with the yellow fever plague. The outfits are used for spraying a special chemical mixture upon the walls of contaminated houses and buildings. As the application is made under pressure, it is far more efficacious than when applied by other methods, and with the spray gun a much greater area can be covered by one man in any given period of time. The similar use of DeVilbiss equipment by other tropical communities will probably follow, it is stated.

New Rouge for Chromium

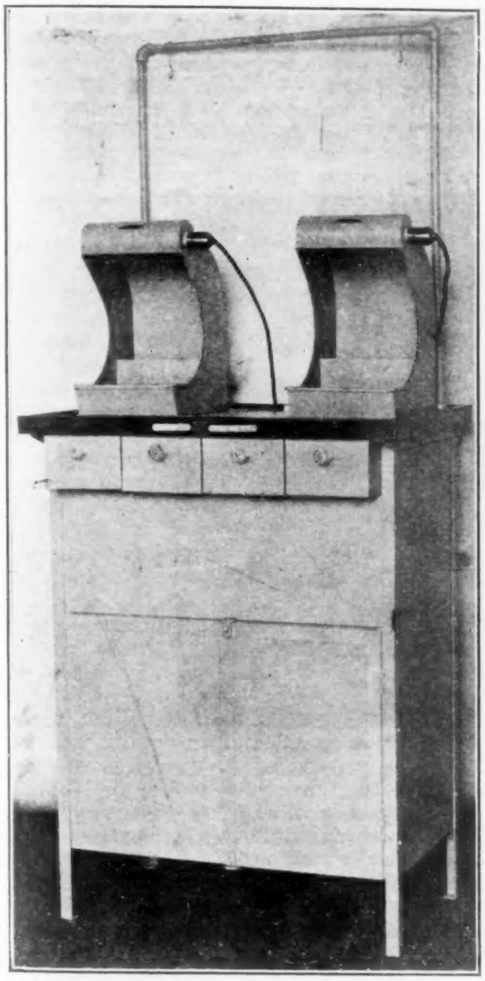
A new polishing rouge for use on chromium plated products has been developed and placed on the market by E. Reed Burns and Sons, Inc., Chicago, Ill., and Brooklyn, N. Y., manufacturers of polishing and buffing equipment and materials. The new material is sold under the name of "Colorchrome," and is made in two colors, green and white. The makers state that the oxide is carefully checked to prevent work from being scratched and the grease bond is stated to be completely saponifiable.

Some of the grades of the new material are hand rolled, making for a high quality product. The No. 10 Green grade is recommended for producing a very fine polish on flat chromium plated surfaces. It is stated that this grade is being used extensively by jewelry makers. The No. 22 White operates more rapidly and is recommended by the makers for work that has a burnt or frosted surface. Several other grades are also made.

Jeweler's Polishing Machine

A new type of polishing machine with dust collector table suitable for display in jeweler's shops and other places where a small polishing unit is required or where such work is done in view of the public, has been designed and placed on the market by Leiman Brothers, 23 Walker Street, New York City, for the past forty years makers of machinery of various kinds.

The machine shown in the illustration is a dust collecting table



New Type Polishing and Grinding Machine

on which the small polishing lathe is set. The hoods are constructed so that the wheels turn directly under them, the dust being carried away immediately. Powerful suction draught is provided by a motor under the table which operates a suction fan. The machine not only makes for cleanliness in stores and other work places, but also aids the user to save every bit of precious metal removed in the polishing operation, the makers state. The table has several drawers and a swinging glass panel is provided which may be lettered with some suitable advertising matter to attract attention and business to the machine.

The motor operates directly from any light circuit and is shipped ready to operate. The company is offering the machine as an attraction for fairs, stores, amusement parks, store windows and other places where rapid cleaning or polishing of jewelry and other articles can be done for the public.

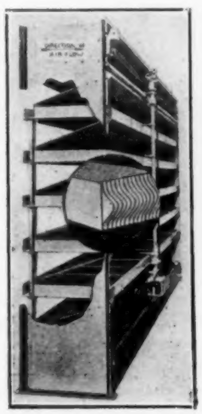
Spraying Equipment

The Spray-Lac Manufacturing Company, 5635 Harper Avenue, Chicago, Ill., successors to the Mellish Hayward Company's spray equipment department, has issued a number of descriptive pamphlets on its products, which include paint and lacquer spraying equipment for all sizes for various applications, spray booths, portable spraying equipment for refinishing automobiles and trucks, etc.

One of the chief products of the company is the "Melrock" spray finshing cabinet, in connection with which the "Pneu-Gun" spraying apparatus is marketed. The cabinet is a fully ventilated chamber, designed to give protection to the operator and to minimize fire risk.

New Air Cleaning Development

The cleaning of air for hygienic or industrial purposes is still a comparatively new science that is little known except to a relatively small number of engineers who have specialized in air conditioning. Developments in this science have come with lightning-like rapidity and it is difficult to realize that less than a decade ago filters for the removal of atmospheric dust were practically unknown. As in most industries, necessity has been the mother of invention. We find an increasingly high dust content in the air, arising from a multiplicity of causes, demanding its elimination in the factory, the sky scraper and in the processes from which innumerable of our twentieth century necessities and luxuries arise. There is hardly an industry or a type of building where air filters are not needed to some extent. Many industries are just beginning to awaken to the possibility for better production and more sanitary working conditions which air filters afford.



Sinuous Filter Medium

Official figures show that in and around New York City, the deposit on the ground of dust particles amounts to 250 pounds per square mile per year. In Pittsburgh the figure amounts to four hundred pounds, and 150 pounds is just a good average for any section. From a health point of view, we fortunately have in our respiratory system, protective devices which get hold of the greater part of the inhaled dust. However, a city dweller's lungs do get tough and tawny due to insoluble dust.

Although today the use of air filters for supplying clean air to human beings (building ventilation) is even more widespread than their industrial application it is doubtful whether this new science would ever have come into being had it not been for demands originating in the industrial field. To brewers and electricians we are indebted for the original developments along this line. The former found that bacteria in the air damaged—and in some cases completely spoiled—the brew. In the case of the latter, when turbo generators came into use it became evident that, unless dust could be removed from the air used to cool the coils, exceedingly expensive equipment would soon be destroyed. To meet these situations, air filters were developed. The first commercially practical air filter was introduced in this country in 1922. It was in the form of unit cells, each containing a labyrinth of oil-coated metal filter sheets through which air was forced. The dust particles were thrown against the oil coated metal by centrifugal force set up by innumerable small swirls and eddies within the finely divided filter media.

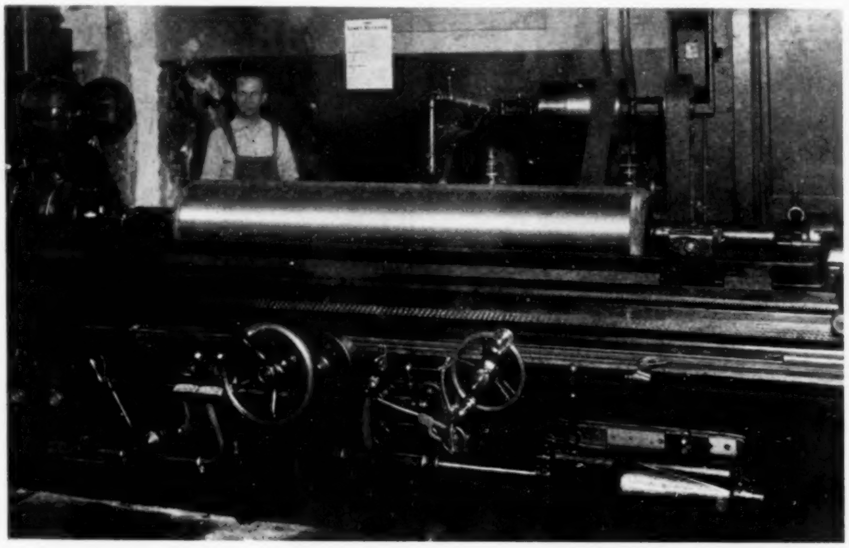
Before the utilization of this centrifugal principle dust had been screened through a filter medium consisting of air passages smaller than the size of the dust particles to be caught. Such a proposition meant the clogging up of the filter within a very short time and, therefore, it was highly impractical. Since then the centrifugation idea has been improved by the introduction of automatic self-cleaning filters, incorporating more and more efficient filter media, according to Midwest Air Filters, Inc., Bradford, Pa., makers of this type of equipment. It is interesting to note that when the first centrifugal air filter was placed upon the market by Midwest in 1922, it cut down the cost of air cleaning to one tenth its former figure, it is stated. Since then, and up until the development of the new sinuous filter medium, there was a gradual improvement in the labyrinth type of filter medium, mainly in the direction of larger dust storage capacity. But it remained for the introduction of the new sinuous type filter medium to cut down the cost of filtered air to one half or one third of what the original Midwest filter required, this company claims, and where the cost of filtered air formerly prohibited its use, it is now available at a figure so low as to make it desirable. More numerous and less expensive filters, together with increasing appreciation of the value and application of air filters, points the way to a widespread popularity for the new Midwest sinuous air filter, it is stated.

Precision Grinding of Non-Ferrous Metals

An interesting article on the subject of grinding non-ferrous metals such as copper, brass, zinc, aluminum, bronze, bearing metals and other non-ferrous alloys has been prepared by the Norton Company, Worcester, Mass., manufacturers of abrasives. The data, issued in the company's publication, "Grits and Grinds," contains references to Norton products such as Crystolon and Alundum of various grades. The article follows:

Probably the bulk of precision grinding in the non-ferrous field has been on pistons made of aluminum and aluminum alloys such as Lynite, Bohnite, Duralumin.

Because aluminum is a soft yet very tough metal it is most essential to use a wheel and work speed that will cut instead of tear the metal. The selection of a proper grain and grade of wheel is of equal importance.



Grinding a Large Copper Cylinder

The usual method used to finish pistons is to use a wheel about 2 in. wide, feed straight in at one end and removing from 0.00025 in. to 0.0005 in. per pass.

A good finish depends largely upon proper wheel speeds, plenty of good clean grinding compound and timely dressing of the grinding wheel. It is very important that the lubricant be strained to remove particles which might cause deep scratches in the work.

A very good cutting compound for this work is a mixture of kerosene and lard oil.

It has been our experience that very good results have been obtained with 46-J to 30-M Crystolon vitrified wheels, running at speeds varying from 5500 to 6000 s. f. p. m. and with work speed of 150-300 r. p. m.

The medium high wheel speed and high work speed are necessary due to the soft nature of the alloy. Too slow speeds would result in small particles being pulled out rather than being cleanly cut.

Another common cylindrical grinding operation encountered on aluminum is the finishing of bushings. This is usually done on a universal machine or a lathe equipped with a tool post grinder. Small Crystolon wheels 6" or 8" x ½" grain 60 grade 2 or 3 shellac will give good results.

Internal grinding of aluminum is confined almost entirely to the grinding of bushings. Where possibly a lubricant should be used, the same compound used in piston grinding should be found very satisfactory. A grain 24 grade J Crystolon vitrified wheel will give very good results.

Surface grinding of aluminum would take in small castings and parts not covered by the previous notes. It can be done on a plain surface grinder or on one of the vertical spindle type. There are several factors which influence the wheel action, but in general the same grain and grade of wheels used on internal grinding will prove satisfactory, except on the vertical spindle type where a 3824 grade I Alundum silicate wheel is good for all around work.

Not very much can be said on precision grinding of brass alloys. The work is principally on small castings and odd pieces. Crystolon vitrified wheels ranging from 36 to 60 in grain size and grades J to L in hardness and selected according to finish desired should prove satisfactory. A wheel speed of 5000-6000 s. f. p. m. and work speeds varying from 150-300 r. p. m. with the use of a good lubricant kept clean by straining will give a good finish.

The grinding of bronze is practically the same as brass. Loading of wheel is one obstacle to be overcome and wet grinding should be used whenever possible. A medium high wheel and work speed will help overcome this condition. Wheels running at a speed of 4500-6000 s. f. p. m. and work speeds of 80-200 r. p. m. should prove satisfactory, wheels of grain 36 to 46 grades J to L should give a good finish under such conditions.

Very little precision grinding is done on copper except in the finishing of copper rolls. A few parts for commutators might be classified under this heading and for such work a 60-2½ Crystolon shellac wheel would do well.

Copper roll grinding is a very broad subject and much might be said of it. Copper is very difficult to grind satisfactorily. It has a tendency to tear apart instead of cutting clean. Wheel and work speeds are therefore a very important factor. For roll grinding a 100-I Crystolon vitrified wheel has given very good results.

Cleaners for Metal

An interesting 34-page book has been issued by E. F. Houghton and Company, Philadelphia, Pa., manufacturers of metal cleaners and other products. The book, "Houghto-Clean," treats of this company's great variety of cleaning materials for all branches of the metal industries, describing their uses in various kinds of plants, such as plating, power, automobile service, railroad yards, the oil industry, wire mills, general plant cleaning operations and others.

The book is divided into chapters, beginning with a general introduction on the subject of metal cleaning, giving general directions. Then various tanks and tank systems are described and discussed, together with such matters as agitation, pumping, washing machinery, steam used in cleaning, plating and cleaning in one solution, cleaning before various other processes such as vitreous enameling, all the well known electro-deposited finishes, galvanizing, rustproofing, etc. The book is well illustrated and gives complete data on the Houghton products for cleaning metals. A list of distributors is included.

Split Pattern Foundry Machines

A survey of the performance of split pattern foundry machines manufactured by the Tabor Manufacturing Company, Philadelphia, Pa., has been made by the A. C. Nielson Company, engineers, in collaboration with Howard Sheeler, president of the Sheeler-Hemsher Company, Philadelphia, in whose plant the machines are in use. This survey is here republished in part from "Graphite," a publication of the Joseph Dixon Crucible Company, Jersey City, N. J., all claims outlined being the opinion of the engineers making the survey:

In molding brass and aluminum at the foundry of Sheeler-Hemsher Company, Philadelphia, Tabor machines have proved themselves, after years of service, able to give entire satisfaction and a reduced molding cost.

The foundry does a jobbing business in brass and aluminum and produces castings varying all the way from one ounce to 1000 pounds and in shapes as called for by the trade.

The following Tabor equipment is in use:

1—12" x 18" split pattern machine.
1—24" hand-ram portable rollover.
2—18" jarring squeezers.
1—18" x 24" plain jar machine.

Albany sand is mechanically sieved, tempered and transferred to the floor by hand methods. It is shovelled into the molds which in their turn are mostly moved by hand except in the case of large sizes which require crane service. Metal is poured direct from crucibles into the molds.

Both patterns and flasks may be either of wood or metal with the tendency and preference toward metal for each. As a great deal of the success of molding depends on the condition of both patterns and flasks, care is exercised to keep them in the best of condition at all times.

This survey will describe methods used with the split pattern machine, develop costs for machine molding and make comparison with bench and snap flask methods.

Flasks: With this machine tight flasks of many sizes are used but the size mostly employed is 12" x 18" with a depth varying from 3½" to 5" for both cope and drag. The weight of castings varies from ½ to 20 lb. and the weights of the half molds with sand, flask and plates average 80 pound.

Patterns: Steel pattern plates of 3/16" stock are being used in preference to the heavy iron pattern plates ordinarily employed. An iron plate is first cut down 3/16" in thickness and then fitted with screws so that it can be used interchangeably with any of the thin steel plates. This not only makes patterns easier to handle and more convenient for storage but also effects a saving of $7.00 to $7.50 per mounted pattern. A total of about a thousand such patterns are in use in this shop and the investment in them is approximately $700 less than if iron plate patterns were used.

The thin steel plate patterns have another marked advantage on small-lot work. Some of the plates are line cut at half-inch intervals, with lines running in both directions, and have small holes drilled in them wherever these lines intersect. Patterns for small-lot jobs can then be mounted on these plates, either with glue or by passing screws through a few holes.

A mounting job which formerly took half a day is thus done in 15 to 20 minutes and the steel mounting plate is always usable again for later jobs. It has been found economic to schedule runs of as few as 12 molds on the split-pattern machine in cases where a single fairly large pattern is used in each mold.

Production: The foundry operates 9 hours a day on a 5-day-a-week schedule. Production in nine hours with the machine is 125 molds, with one molder at $9.00 and auxiliary labor amounting to $2.50. This is equivalent to $.09 per mold.

Machine Costs: Based upon an assumed life of 10 years, fixed charges amount to $71.85 a year. Air cost pro-rated to the split pattern machine adds $81.25. With an allowance of $25.00 for lubrication and cleaning the total fixed and operating cost is $178.10—equivalent to $685 a day or $.0055 per mold. Thus the total molding cost—machine and labor—is $.095.

Advantages Over Bench and Snap Flask Methods

In Cost: The survey gives also the outputs and labor costs for bench and snap flask methods. For the former, with loose-pattern molds arranged for multiple-gate pouring, the production is 25 in 9 hours, at a cost of $410 each. The saving is substantial —$.315 per mold and $39.38 a day based on machine production. For the snap flask method a production of 80 molds a day at the same labor cost results in a cost per mold of $.128. The saving being effected by the machine is $.033 per mold and $4.12 per day.

It will be seen that the first cost of the machine is returned in savings over bench work in 12 days, and over snap flask methods in 113 days.

In Rejections: Machine-made molds produce more uniform castings, save in metal and reduce rejections. These are evidenced by the following instances. In one run of 800 pieces only 3 were rejected on inspection. This gives a rejection percentage of .375. The average of rejections runs from 2 to 2½%, in spite of rigid standards.

In Uniformity: In another instance the uniformity of the castings reduced the former average weight of 13 lb. by 2/3 lb. The price was $.30 per lb. and the customer was pleased to get the benefit of this reduction of $.20 per casting. When a machine or ground finish is required on a casting the greater uniformity obtained with the machine reduces the amount of metal which must be removed. Also, because of this uniformity the castings chuck up better, saving time on the lathe.

In Pattern Wear: There is far less wear on patterns. A few wood patterns are still in service that have been in use as required for 20 years. Also, fewer patterns are required than with hand methods, the machine only requiring a half pattern in most cases where hand methods would require a whole pattern.

In Labor: In a comparison of costs the labor reduction is large. In labor alone the reduction is 78% over bench work and 29% over hand-rammed snap flask work.

Summary

Brass and aluminum foundry uses Tabor equipment for wide variety of jobbing work.

Split pattern machine used mostly on 12" x 18" flasks of depths from 3½ to 5 inches. For castings weighing from ½ to 20 lb. patterns and flasks are largely of metal.

Use of thin steel plate patterns has advantages due to:

Lower pattern investment; easier pattern handling and storage; adaptability on small-lot work.

Average production in 9 hours is 125 molds. Molder and auxiliary labor amount to $11.25. Machine cost is $.685 a day. Making cost per mold $.095. Bench methods produce 25 molds a day. Hand-rammed snap flask methods produce 80 molds. At costs respectively of $.410 and $.128. Tabor machine saves 76.8% over bench molding. Saves 25.8% over hand-ram snap flash work. Reduces wear on all patterns. Holds rejection to 2-2.5% under rigid inspection.

Equipment and Supply Catalogs

Battery **Charging Equipment.** General Electric Company, Schenectady, N. Y. Leaflet, illustrated.

Enclosed **Circuit Breakers.** Roller-Smith Company, New York City. Type EAF, free handle, fully described with complete engineering data.

Making **Steel Stand More Strain.** The Brown Instrument Company, Philadelphia, Pa. Broadside on pyrometer control in manufacture of Stillson wrenches.

How to **Bronze-Weld Cylinder Blocks.** The Linde Air Products Company, New York City. Useful information on an important phase of automobile repair work and welding in general.

Easy Cutting Perfect Threads. Armstrong Manufacturing Company, Bridgeport, Conn. Concise tabulation of a wide variety of dies for use with Armstrong stocks.

Telephone Almanac. American Telephone and Telegraph Company, New York City. A small but exceedingly interesting annual booklet issued by a company which is noted for its excellent advertising literature.

Unit Heater Bulletin. L. J. Wing Manufacturing Company,

154 West 14th Street, New York City. Brief outline of history and development of unit heating, with descriptions of Wing factory installations. Illustrated.

Chromium Plating Equipment. Connecticut Dynamo and Motor Company, Lyons Avenue, Irvington, N. J. Leaflet on apparatus for chromium plating; well illustrated. Covers generators, rheostats, exhaust fans, small chromium outfit for jewelers, etc.

White Metal and Brass Pattern Letters and Figures. H. W. Knight and Son, Seneca Falls, N. Y. Catalog of pattern letters and figures used in production of lettered and figured metal castings, tablets, monuments, etc. Other equipment for this work is also included.

Electro Chemical Deposition of Metals. Fescol, 101 Grosvenor Road, Westminster, London, Eng., S.W.1. A 128-page book covering in an interesting fashion a patented process of plating with nickel, copper, chromium, cadmium, cobalt, iron, lead or zinc. A great number of illustrations are included.

"D-12" and "Conqueror" Engines: Their Use of Nickel Alloy Steel. The International Nickel Company, Wall Street, New York City. Pamphlet giving detailed information on the use of nickel steels in the two Curtiss airplane engines mentioned in the title. Also covers the nickel-aluminum alloy pistons used in these machines. Well illustrated.

Water Services That Serve. Copper and Brass Research Association, 25 Broadway, New York City. General data on copper and brass tubing and pipe with special reference to copper for use in service pipe between water mains and house lines. Tables of engineering data are included, giving various properties, such as strengths, pressures possible, sizes, lengths, etc.

The A B C of Hydrogen Ion Control. LaMotte Chemical Products Company, Baltimore, Md. This is the fifth and enlarged edition of a work that has proven its worth in past years as a combintaion catalog and textbook. The extensive use into which control of acidity and alkalinity by means of hydrogen ion measurements has come makes this book highly valuable to everyone interested in production of high quality plated ware. It covers the subject thoroughly, from the definition of hydrogen ion concentration and the applications of pH values through various methods of measurement, materials for analysis and control and various other important phases involved.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

American Electroplaters' Society

Chicago Branch

HEADQUARTERS, CARE OF S. J. C. TRAPP, 1127 NORTH 7TH STREET, MAYWOOD, ILLINOIS.

Annual Banquet and Session

The Chicago Branch of the American Electroplaters' Society held its annual educational session and banquet at the Hotel Sherman, Chicago, on January 26, with the largest attendance it has ever had at this function. There were 325 at the educational session, where a highly interesting group of papers were delivered. The session was presided over by Oscar E. Servis, Librarian of the Branch, who introduced as the first speaker Robert Meyers, president of the Branch. Mr. Meyers welcomed the large gathering of platers, manufacturers and chemists present. The papers read were as follows:

The Future of Chromium, by Professor Edwin M. Baker, of the University of Michigan. His paper was illustrated with lantern slides and charts, and gave the results of tests of a great variety of chromium deposits, showing the thicknesses, durability, usefulness and appearance of the various plates tested. He concluded by declaring that the future of this field of plating depends to a large extent upon the quality of the chromium deposits produced on goods used by the public. In discussion following the paper he stated that a "good" chromium deposit is one that is rust-resisting to weather for 1½ years, or to rubbing and washing for 3 years. Such a deposit requires from 300 to 600 ampere minutes. A chromium deposit directly on brass is not economically satisfactory, he said, because it will not resist wet weather, although in dry weather it might be satisfactory. Asked whether this applied to red as well as to yellow brass, he said that deposits direct on yellow brass are poor, on red brass intermediate and on copper very good. He stated that a nickel strike is preferable to a copper strike on brass before chromium plating, but that a nickel flash is difficult to put on yellow brass as if adherence is needed.

Modern Methods of Tin Deposition, by Charles H. Proctor, founder of the Society and plating editor of THE METAL INDUSTRY, was the next paper. Mr. Proctor's paper was found highly interesting, as were some exhibits of tin deposits which he handed around.

Impromptu Remarks on Chromium Plating, by Erwin Sohn, research director of the Standard Sanitary Company, Pittsburgh, the next paper, gave a number of excellent suggestions and brought out the point that an excessively high sulphate content in a chromium bath wastes current and makes for poor, cracked deposits.

The Theory of Chromium Plating was discussed by Oliver P. Watts of Wisconsin University. He gave many valuable points and touched upon the practical application of the theory. He mentioned the use of hydrochloric acid with 2 per cent of formalin by volume for stripping chromium plate from steel. Another interesting point was mention of the old nickel "doctor" in connection with chromium work. He suggested wrapping the lead anode with asbestos cord, and that work being "touched up" be kept warm.

The Truth About Chromium was a paper read by Jacob Hay, of the C. M. Hall Lamp Company, Detroit.

Considerable discussion of various phases of chromium work followed the papers.

Bridgeport Branch

HEADQUARTERS, CARE OF WILLIAM EHRENCHRONA, 872 HANCOCK AVENUE, BRIDGEPORT, CONNECTICUT

Annual Session and Banquet

The Bridgeport Branch, American Electroplaters' Society, will hold its annual educational session and banquet at Bridgeport, Conn., on April 20, 1929. Details regarding the program will be included in the following issue.

Hartford-Connecticut Valley Branch

HEADQUARTERS, CARE OF GRANT VERNON, 43 PUTNAM STREET, BRISTOL, CONNECTICUT

Annual Banquet

The Hartford-Connecticut Valley Branch of the American Electroplaters' Society will conduct its annual educational session and banquet on May 11, 1929.

Milwaukee Branch

HEADQUARTERS, CARE OF J. N. HOCK, 1229 WEST 24th STREET, MILWAUKEE, WIS.

Annual Banquet and Session

The Milwaukee Branch of the American Electroplaters' Society will hold its annual educational session and banquet on Saturday, April 6, at the Schroeder Hotel, Milwaukee.

The session will begin promptly at 2:30 p. m., and the banquet at 7:00 p. m. The latter will take place in the Green Room and there will be entertainment and dancing after the dinner. The following papers are to be presented at the session:

Chromium Plating—A New Lease of Life for the Plater, by N. De Cesare.

Modern **Lacquers,** by E. H. Bucy.
Address Charles H. Proctor.
Troubles of a **Chromium Plater,** by R. F. Mac Guire.
Overcoming **Spotting Out on Plated Articles,** by R. J. Hazucha, Maas and Waldstein Company, Newark, N. J.

Discussion will follow the papers and all platers, chemists and plant executives in the Milwaukee district are urged to come and get the benefit of this important session.

—BANQUET COMMITTEE.

Newark Branch

HEADQUARTERS, CARE OF R. F. SMITH, P. O. BOX 201, NEWARK, N. J.

All-Day Session and Annual Banquet

The Newark Branch of the American Electroplaters' Society will hold its annual session and banquet on April 6, 1929, at the Elks' Club, Newark, N. J.

The session will be unique in that the whole day will be given over to papers and discussions of the technique and theory of electroplating. In connection with this all-day session will be held the conference of the Research Committee of the American Electroplaters' Society, the details of which are given on page 122 of this issue. This conference is being held in Newark instead of in Washington, D. C., as usual, in order to make it more convenient for platers to attend, and it is hoped that all platers, chemists, plant executives and others interested in the plating industry will attend for the day's session and gain the benefits that will accrue to those who hear the papers and enter the discussions. Many important phases of electroplating will be discussed and the Research Associates of the American Electroplaters' Society, who have been working together with the Bureau of Standards in Washington will give the results of their investigations to date.

The program arranged by the Newark Branch also includes a number of important contributions to the art of electroplating which no progressive plater can afford to overlook.

The morning session will start at 9 a. m. and last until noon. The afternoon session will be from 2 to 5 p. m.

In the evening the Branch will hold its annual banquet and entertainment, which, as usual, will be in every manner as enjoyable as the committee can possibly make it. To this, too, all platers and their friends are invited. Reservations should be made as early as possible by communication with the secretary at the above address.

—ROYAL F. SMITH, Secretary.

New York Branch

HEADQUARTERS, CARE OF R. J. LIQUORI, 2429 HUBBARD STREET, BROOKLYN, N. Y.

A full report of the annual banquet and educational session of the New York Branch of the American Electroplaters' Society will be found on page 123 of this issue.

On Friday evening, March 8, the Branch held a meeting at the regular meeting place, Room 611, World Building, Park Row, New York City, at which the report on the banquet and session was delivered by the secretary of banquet committee.

There will be another meeting this month on Friday evening, March 22, at which important business will be transacted. All members and other platers interested in the progress of the industry are urged to attend this meeting, which will take place at the regular meeting place stated above.

—RALPH J. LIQUORI, Secretary.

Rochester Branch

HEADQUARTERS, CARE OF C. GRIFFIN, 24 GARSON AVENUE, ROCHESTER, NEW YORK

Annual Session and Banquet

The Rochester Branch of the American Electroplaters' Society will hold its annual educational session and banquet at Powers Hotel, Rochester, New York, on Saturday, April 13, 1929.

The following committee has been appointed to make all arrangements: Charles Griffin, Raymond Lopez, Clarence Reama, John Snyder, William Hart and S. P. Gartland. They promise that this will be one of the finest educational sessions ever held in western New York, and that all platers in the territory will do well to attend. All other platers desiring to attend are also urged to do so, and they are promised that they will not regret their decision to try out Rochester's banquet and entertainment.

The educational session will start promptly at 3.00 p. m., and the banquet at 6.30 p. m. Eli J. Beaudry will be in charge of the music for dancing after the banquet.

CHARLES GRIFFIN, Secretary.

American Society for Testing Materials

HEADQUARTERS, 1315 SPRUCE ST., PHILADELPHIA, PA.

The following are among the committees of the American Society for Testing Materials, and certain sectional committees, are holding meetings in conjunction with the four-day annual spring group meeting to be held in Chicago at the Stevens Hotel over the dates of March 19, 20, 21 and 22:

B—1 on Copper Wire.
B—3 on Corrosion of Non-Ferrous Metals and Alloys.
B—7 on Light Metals and Alloys.
Research Committee on Fatigue of Metals.
Sectional Committee on Zinc Coating of Iron and Steel.

Lighting Equipment Association

HEADQUARTERS, 711 GRAYBAR BUILDING, LEXINGTON AVENUE, NEW YORK CITY

Managing Director's Report

The report of Granville P. Rogers, managing director of the Artistic Lighting Equipment Association, covering activities of the association for the year 1928, has been published by the association and is available to members of the lighting equipment and allied industries.

Waste Material Dealers' Association

HEADQUARTERS, 1109 TIMES BUILDING, NEW YORK CITY

Metal Division Meeting

Chairman Jarvis of the Metal Division of the National Association of Waste Material Dealers has called an important meeting of the division for Wednesday, March 20, at 10 a. m. This will take place at the Congress Hotel, Chicago, where the whole organization will be in convention for the sixteenth annual meeting and banquet, which takes place there this year. In regard to the Metal Division meeting, it is stated that several important matters, including some committee reports, are to be considered at this meeting, and in view of the activity of the metal market at the present time everything points to a very large attendance at the meeting of that Division.

Nominating Committee

The nominating committee of the Association has submitted the name of Henry Lissberger, of the Federated Metals Corporation, New York, for president.

British Institute of Metals

HEADQUARTERS, 36, VICTORIA STREET, LONDON, S. W. 1

Annual General Meeting

The twenty-first annual general meeting and "Coming-of-Age" celebration of The Institute of Metals of Great Britain took place this year in the Hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S. W. 1, on Wednesday and Thursday, March 13 and 14. The annual dinner was held on March 13 at the Trocadero Restaurant and was followed by a dance. The following day there was held a Conversazione at the new Science Museum in South Kensington, in connection with which a metallurgical exhibit was held.

The following list gives the papers presented at the meeting. Abstracts of these will appear in a forthcoming issue:

Recent Developments in Electric Furnaces, by D. F. Campbell.

An Improved Form of Electric Resistance Furnace, by W. Rosenhain and W. E. Prytherch.

Note on the Testing of Electrodeposits on Aluminium, by G. B. Brook and G. H. Stott.

The Importance of Design and Setting of Large Kettles Used for Refining and Low Melting Point Alloys, by H. C. Lancaster.

Brittleness in Arsenical Copper—II, by Clement Blazey.

Special Properties of Eutectics and Eutectoid Alloys in Binary Metallic Systems, by Prof. P. Saldau.

Work-Softening and a Theory of Intercrystalline Cohesion, by F. Hargreaves and R. J. Hills.

The Age-Hardening of Some Aluminium Alloys, by M. L. V. Gaylor and G. D. Preston.

The Constitution of Cadmium—Rich Alloys of the System Cadmium—Gold, by P. J. Durrant.

The System Magnesium—Zinc, by W. Hume-Rothery and E. Rounsefell.

Alloys of Zirconium—II, by C. Sykes.

The Resistance of Zinc to Indentation, by J. N. Friend and W. E. Thorneycroft.

The Solution of Plain and Amalgamated Zincs in Electric Batteries, by J. N. Friend and W. E. Thorneycroft.

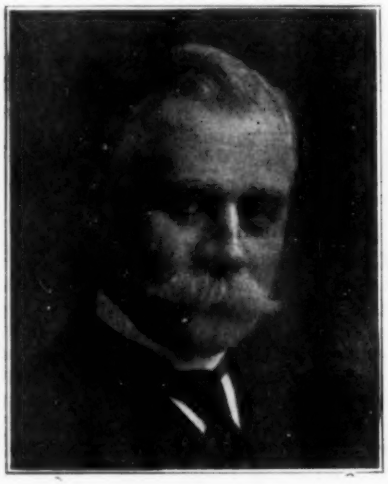
The Silver Contents of Specimens of Ancient and Mediaeval Lead, by J. N. Friend and W. E. Thorneycroft.

A Note on the Haughton-Hanson Thermostat. A Method of Fine Adjustment, by P. J. Durrant.

Personals

John A. Coe

John Allen Coe, who was recently elected president of the American Brass Company for the tenth successive yearly term, was born in Beacon Falls, then a part of Bethany, Conn., August 23, 1868, the son of John A. and Cornelia (Wakelee) Coe. He is a direct descendant of Robert Coe, who came from Suffolk County, England, in 1634 and finally settled in Stamford, Conn. The father of the subject of this sketch was a manufacturer of leather belting in Brooklyn, N. Y.



John A. Coe

Mr. Coe was educated in the public schools and in 1885 entered the employ of the Osborne and Cheeseman brass factory in Ansonia, Conn. Two years later he became a machinists's apprentice with the Guild and Garrison Company of New York and stayed there for five years. In 1892 he came to the Birmingham Brass Company of Shelton, Conn., as assistant superintendent, later becoming its secretary and treasurer, in which position he remained until 1903. Then he resigned to become sales manager for the American Brass Company, which had recently been formed.

Within a few years he became assistant to the president of the American Brass Company, who was then Charles F. Brooker, and in 1913 he was made vice-president and a director. He became president in 1920, when Mr. Brooker became chairman of the board of directors. He is the second president the company has had since its organization, and has held that position ever since. Although owned by the Anaconda Copper Mining Company, the American Brass Company has a number of subsidiaries. They are the Anaconda-American Brass Company, Ltd., of New Toronto, Can.; the Ansonia Light and Water Power Company; the American Metal Hose Company of Waterbury; the New York and Hastings Steamboat Company; the Waterbury Brass Goods Corporation; the Waterbury Homes Corporation.

Mr. Coe is president and a director of the Anaconda-American Brass Company of New Toronto, the Waterbury Brass Goods Corporation and the Waterbury Homes Corporation; vice-president and a director of the American Metal Hose Company, the New York and Hastings Steamboat Company, the Waterbury Savings Bank; a director of the Colonial Trust Company of Waterbury, the Torrington National Bank, the Torrington Manufacturing Company, the Ansonia Light and Water Power Company, and the Torrington Printing Company. He has recently been elected president of the Hendey Machine Company of Torrington.

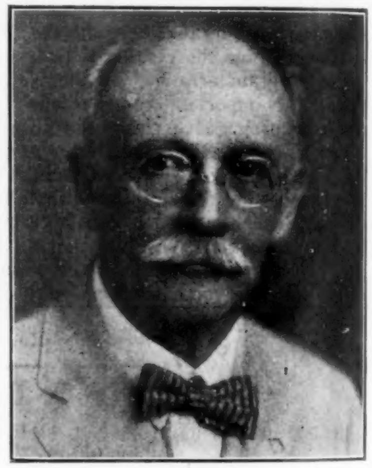
He is a member of the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers. He is a trustee of the Methodist-Episcopal Hospital of Brooklyn, N. Y., a member of the board of agents of Bronson Library, Waterbury, and president of the board of trustees of the First Methodist Church of Waterbury, of which he is a member. In politics he is a Republican.

He is a member of the Masonic fraternity, the Bankers' Club of America, the Union League Club of New York, the Recess Club of New York, the Waterbury Club, Waterbury Country Club and the Torrington Club. He was married, May 25, 1892, to Jesse M. Boice, the daughter of John Boice of Cairo, N. Y. He has two children, Helen, the wife of Allen H. Boardman of Waterbury; and John A. Coe, Jr., also of Waterbury.

—W. R. B.

Dr. Edward Weston

Dr. Edward Weston, president of the Weston Electrical Instrument Company of Newark, N. J., and widely known for his important work in connection with the deposition of nickel in the early days of the plating art in America, has just established a fellowship in electrochemistry, to be known by his name, and to be administered by the American Electrochemical Society, New York. This endowment is described on another page of this issue.



Dr. Edward Weston

Dr. Weston was born in England May 9, 1850, and there studied medicine. He came to the United States in 1870, entering the employ of the American Nickel Plating Company. He is responsible for many improvements in the nickel-plating art. At that time the electroplating industry was very much hampered by the lack of low voltage generators and Dr. Weston set about to invent several new types of dynamo electro machines and established in Newark in 1875 the first factory in America devoted exclusively to that class of machine. In 1881 his plant was consolidated with the United States Electric Lighting Company of which he was electrical engineer till 1888. At that time he formed a new company, the Weston Electrical Instrument Company, of Waverley Park, Newark, New Jersey, for the main purpose of manufacturing the Weston electrical instruments—voltmeters, ammeters, etc. He has been president of this concern for a good many years. The well-known Weston cadmium cell is the fundamental volt standard throughout the world. Dr. Weston has been the recipient of many honors and awards for his contributions to science.

Gustav H. Niehmeyer, vice-president of Handy and Harman, New York City, will direct the sales, manufacturing and refining operations of that company, succeeding to the duties of **George C. Gerrish** who has resigned as vice-president in charge of manufacturing and refining operations. **Robert H. Leach** has been appointed manager of the company's Bridgeport plant.

Colts Patent Fire Arms Manufacturing Company of Hartford, Conn., makers of Colt "Autosan" dish and silver cleaning machines, announce two important additions to their sales personnel, effective February 15. On that date **Thomas M. Small** was appointed to take charge of the sales and service activities of the New York territory, including New Jersey, Philadelphia and Washington. Mr. Small will be assisted in

this district by **Russell Chico**, who is well and favorably known in the hotel and restaurant field throughout the metropolitan district. The New York office of Colts Patent Fire Arms Manufacturing Company, Autosan Division, will remain at its present address, 20 Vesey Street. Because of increased interest in "Autosan" machines throughout the middle west, **H. A. Seiferman** has been appointed to take charge of sales and service activities for the Cleveland district. Mr. Seiferman's territory will include cities as far east as Buffalo and Rochester. This territory was formerly covered by the Chicago office.

Horace E. Hall has been appointed sales manager of the Zeller Lacquer Manufacturing Company, 20 East 49th Street, New York City.

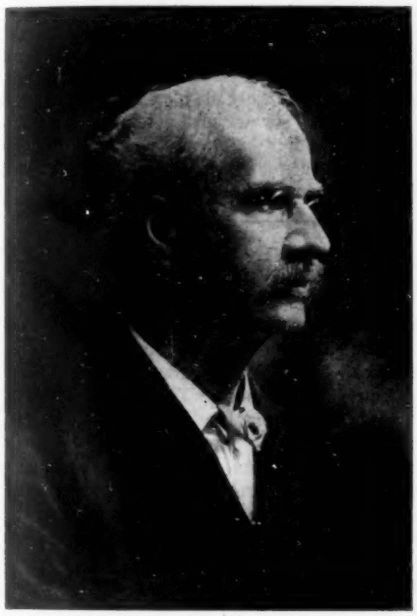
Captain M. F. Behar has been appointed advertising manager of the Quigley Furnace Specialties Company, 26 Cortlandt Street, New York City.

Obituaries

Robert B. Macdonald

Robert B. Macdonald, manufacturing jeweler, of Attleboro, Mass., died suddenly on February 4, at his home, 16 First Street, Attleboro. He was in his 83rd year and had been identified wtih the Attleboro jewelry industry the greater part of his life.

Mr. Macdonald, who was a pioneer in the jewelry industry, was born into a pioneer family in Pennsylvania in 1845. His family moved to the west, then in a very primitive condition, when Robert was still a boy. Later his parents brought him to Pawtucket, then Massachusetts, and later to Attleboro, where his father was a farmer. His first entry into the jewelry field was with the B. S. Freeman Company, where he stayed for four years, when he left to start his own small shop. He manufactured swivels, watch chains and toilet articles. His firm prospered and its descendant is now known as R. B. Macdonald and Company, manufacturing jewelers.



Robert B. Macdonald

Mr. Macdonald is survived by a son and two daughters.

Julian R. Holley

Julian R. Holley, 73, vice-president of the Bristol Brass Corporation, died at the breakfast table at his home in Bristol, Conn., on February 15, due to acute indigestion. He came to this city as a bookkeeper for J. M. Todd at an early age and later entered the employ of the Bristol Brass Company. After five years he became secretary and assitant treasurer. In 1893 he was made treasurer and held that office until a few years ago, when he was made vice-president.

He was a director of the Bristol National Bank, the American Trust Company and the American Silver Company.

He is survived by his widow, one son, Julian, of Boston, and a daughter, Margaret S. Holley of this city.

—W. R. B.

Harvey A. Call

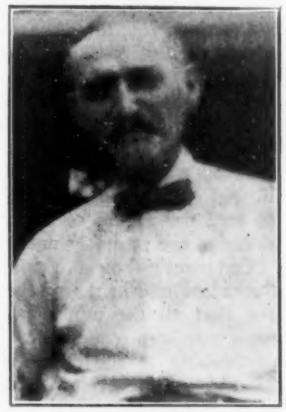
Harvey A. Call, of the research department of the Copper and Brass Research Association, died on February 8, in New York, after an illness of four days. An attack of influenza which developed rapidly into pneumonia was the cause of Mr. Call's sudden death.

Mr. Call is well known in the plumbing and heating trades, having been for many years editor and treasurer of "Sanitary and Heating Engineering."

John A. Gottsman

John A. Gottsman, of the H. J. M. Howard Manufacturing Company, Washington, D. C., electroplaters, died November 10, 1928.

Mr. Gottsman was a well known electroplater in Washington, where he was born on October 15, 1876. He attended the public schools there. At 17 he started to learn the electroplating trade, working in the old Post Office building under W. D. Doremus. After becoming a first-class buffer and polisher he went with the firm of Doremus and Just, who were located in the Star Building. Later Mr. Gottsman decided to learn the art of gold plating and he worked for a time without compensation to get this knowledge.



John A. Gottsman

At 23 he was an accomplished gold plater and he became a member of the Doremus and Just firm. This company had to vacate its premises in the Star Building when that edifice was torn down to make room for the new Star Building, and later Doremus and Just was dissolved. Mr. Gottsman then became foreman plater for the Doremus Machine Company, where he remained for about seven years.

In 1910 he again decided to enter business for himself, and he arranged to become a partner in the Howard company, where he remained until his death. All during his career he was intensely interested in the profession of electroplating and he worked constantly to perfect his knowledge of this work. He was a member of the American Electroplaters' Society, Philadelphia Branch, for many years.

George J. Belle

George J. Belle, foreman of the electroplating and lacquering department of the Harvey Hubbell Company, Inc., Bridgeport, Conn., died suddenly on October 22, 1928, at the age of forty-five.

Mr. Belle was born in Frankfort, Germany, in 1882, and came to this country in 1902. He started with the Hubbell company as an ordinary laborer and worked himself up to the position of head of the plating and lacquering department by dint of study and determination to succeed. During his career as an electroplater, he was president of the Bridgeport Branch of the American Electroplaters' Society, and was highly esteemed by the members of that organization. In 1926 Mr. Belle was awarded first prize for his exhibit at the Newark convention of the American Electroplaters' Society.

Harold J. Horn

Harold J. Horn, 52 years old, of Pennington, N. J., died recently at his home there. For the last 30 years Mr. Horn had been employed by the John A. Roebling's Sons Company, and at the time of his death was assistant production manager. He was born in Hellertown, Pa., and was graduated from the Bethlehem, Pa. high school. He entered Lehigh University with a scholarship in 1898, as valedictorian of the engineering school. In recognition of his excellent scholastic work he was awarded the key of Tau Beta Pi, honorary intercollegiate engineering society. Upon graduation he entered the employ of the Roebling Company and rose to the position of assistant production manager.

—C. A. L.

Raphael E. Gallaher

Raphael Eccleton Gallaher, president of the New York Insulated Wire Company, died at his residence at 375 Park Avenue, New York, on February 10, at the age of 78.

Mr. Gallaher was a pioneer in the wire and cable industry. In 1884 he organized the New York Insulated Wire Company. He held the position of secretary of this company from the time it was organized until 1927, when he became president. He was very widely known in the wire and cable industry.

John Clark Codman

John Clark Codman, treasurer and manager of the F. L. and J. C. Codman Company, Boston, Mass., manufacturers of buffing and polishing wheels, died February 7, 1929.

News of the Industry

Industrial and Financial Events

Anaconda Copper Mining Company

Directors of the Anaconda Copper Mining Company, parent of the American Brass Company, Waterbury, Conn., on March 5 voted to wipe out the funded debt of the company by offering new stock to its stockholders to the amount of $150,000,000. This plan is still to be approved by the company's stockholders at a meeting on March 14. In a joint statement regarding this refunding plan, Chairman John D. Ryan and President Cornelius F. Kelley, mentioned only the mining divisions of the company, so that the affairs of the American Brass Company and its subsidiaries are probably not affected by it.

Commenting on the copper situation, Mr. Ryan implied that the recent rise in the market did not constitute any sort of menace and that all the mines in the world are producing at maximum rates to keep pace with industrial consumption of the metal, particularly in the electrical field. American supplies of copper, he said, are not being exhausted, the average recovery from ore being one-third higher than 20 years ago, with the general recovery estimated at around 90 per cent. Mexican political affairs, he said, would probably have no affect on copper production there.

New Telephone Construction

A construction program calling for an expenditure of nearly $82,000,000 on new long distance telephone facilities during 1929 has been authorized by the American Telephone and Telegraph Company, according to an announcement by T. G. Miller, general manager of the long lines department of that company. This is an increase of 67 per cent over the amount spent by the company for similar work in 1928, the previous record year in construction.

Among the chief construction items sharing in this appropriation are aerial wire lines, telephone cable lines with associated equipment; telephone repeaters, necessary to send the voice currents over great distances; carrier current telephone and telegraph systems, enabling several messages to travel simultaneously over one set of wires; special telephone circuits for transmitting radio broadcasting programs from studios to distant stations; and land and buildings to house the equipment needed to operate and maintain all these facilities. About $42,000,000 of the $82,000,000 will be spent on extending and supplementing the existing long distance cable system.

More than a million loading coils and about 24,000 telephone repeaters will be required in connection with the new and the existing cable lines. They are provided for in the proposed expenditure. Over 74,000 miles of new aerial wire will be strung through the less populated areas during 1929, and the cost of this work, including the construction of new pole lines, is expected to reach $10,000,000.

Verdict for Haskell Set Aside

A verdict granting $8,000,000 damages to George D. Haskell, president of the Bausch Machine and Tool Company, Springfield, Mass., in his suit against the estate of the late James B. Duke, in which Haskell charged the Duke interests had broken a partnership with him in an aluminum producing scheme, was set aside by the United States Circuit Court of Appeals, at Philadelphia on February 21. Mr. Haskell had sought to have the $8,000,000 verdict trebled under the law granting triple damages in cases of damages due to trust law violations. He had maintained that the Duke interests joined with the Aluminum Company of America after breaking their partnership with him, and that their subsequent activities in the aluminum field in Canada and the United States constituted trust law violations which caused him damages of $15,000,000, for which he wanted $45,000,000. The Duke interests, on the other hand, maintained that they had not broken a partnership agreement and the court held that Haskell had not proven that such an agreement had been broken.

Harshaw Chemical Company

A recent meeting of the directors of the Harshaw Fuller and Goodwin Company, Cleveland, Ohio, resulted in several corporate changes of importance. The name of the company has been changed to Harshaw Chemical Company in order to more fully signify the nature of the company's business. The company's preferred stock amounting to $1,000,000 outstanding was unchanged, but the common stock, formerly of $100 par value, was changed to no par value and an issue of 200,000 new shares of no par were authorized. Of this issue, 100,000 shares are to be exchanged for the old common stock and the remaining shares marketed from time to time as the company's affairs may require, 10,000 shares being disposed of at once.

W. A. Harshaw, who since 1924 had been chairman of the board, was elected president, to succeed John A. McGean, who has resigned as director and officer. Ralph L. McGean also resigned as vice-president and director. The other officers of the company are now R. S. Wensley, vice-president; W. J. Harshaw, vice-president; O. J. Hall, vice-president; W. R. Wensley, vice-president; Drake T. Perry, secretary and treasurer.

W. A. Harshaw founded the company in 1892 as the Cleveland Commercial Company, to buy and sell chemicals. He was joined by R. L. Fuller shortly after, and four years later they were joined by W. B. Goodwin. In 1898 the firm reorganized as The Harshaw Fuller and Goodwin Company, and began the manufacture of chemicals at Elyria, Ohio. A. L. Stark was placed in charge of operations there. In 1900 R. S. Wensley joined the organization, and in 1911 J. A. McGean was taken into it. Mr. Goodwin's health was failing by that time and much of his work was taken over by his associates, Harshaw and McGean. Mr. Fuller withdrew from the company in 1916, to return to it again in 1920. Mr. Perry joined the firm in 1923. Mr. Harshaw was president from 1898 until 1924, when he was elected chairman of the board and was succeeded as president by Mr. McGean. Mr. Stark, the firm's chemical engineer, died in 1924 and he was succeeded by W. J. Harshaw, chemical engineer, who took charge of operations. O. J. Hall, W. R. Wensley and R. L. McGean became vice-presidents, and no further changes occurred until the reorganization just announced.

Aviation Show

The New York Aviation Show, under the auspices of the Aviators' Post No. 743, American Legion, took place at the Grand Central Palace, New York City, February 6 to 13, 1929. There were a great many exhibits, largely of planes and accessories, and altogether the exposition tended to reveal the

marvelous progress that is steadily being made in the field of air travel. Many of the airplanes and seaplanes exhibited were made entirely of metal, and, as is well known to everyone in the metallurgical industries, none is without its quota of aluminum alloy, copper, brass, tin, and other non-ferrous metals. Of especial interest to the metal trades were the following exhibits:

Streloff-Naughton Corporation, Long Island City, N. Y., aluminum tanks.

Paramount Welded Aluminum Products Corporation, Brooklyn, N. Y., aluminum tanks.

Pyrene Manufacturing Company, Newark, N. J., fire protection equipment.

Crouse Hinds Company, Syracuse, N. Y., lighting equipment.

Van Schaach Brothers, Chicago, Ill., aircraft finishes.

Keystone Electroplating Company, metallic finishes.

Sturges Company, New York City, batteries.

Oakite Products Corporation, New York City, cleaning compounds, etc.

Robert Bosch Magneto Company, Inc., metal products.

Buhl Stamping Company, manifolds.

Weston Fellowship in Electrochemistry

Dr. Edward Weston, electrochemist and engineer of international reputation, has established the Edward Weston Fellowship with the American Electrochemical Society, New York City. The candidate will be selected by the Society and selection will be based on marked capacity in carrying out research in the science of electrochemistry or its applications. The award will be made without distinction on account of sex, citizenship, race or residence. The successful candidate may carry out his research at any university or institute approved by the Society. The date of the first award, which will be approximately $1,000, is not definitely fixed but will probably be in the fall of this year. Those interested should apply to the office of the American Electrochemical Society, Columbia University, New York City.

Jewelry Production Lower

The Department of Commerce announces that, according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged primarily in the manufacture of jewelry in 1927 reported products to the value of $164,865,057, a decrease of 1.2 per cent as compared with $166,816,370 for 1925, the last preceding census year. The total value of products for 1927 was made up as follows: Platinum jewelry, $35,730,369; gold jewelry, $39,482,234; gold-filled and rolled-gold-plate, $11,228,077; gold-electroplated, $3,305,479; silver, $6,086,567; jewelry not reported separately as to kind, $26,289,524; other jewelry, $17,550,771; findings, $15,326,444; miscellaneous products and receipts for custom work and repairing, $9,865,592.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Conn.

March 1, 1929.

Officers of the **American Brass Company** were reelected at the annual meeting of the company held last month. They are: president, John A. Coe; vice-president, Edward L. Frisbie; treasurer, Clifford F. Hollister; secretary, Edmund H. Yates. Directors were reelected as follows: John D. Ryan, Cornelius F. Kelley, John A. Coe, Edward L. Frisbie, Clifford F. Hollister, Edmund H. Yates and Clark S. Judd.

Announcement is made by the **Anaconda Copper Mining Company** of the formation of a subsidiary known as the Anaconda **Wire and Cable Company,** which will acquire the Anaconda rod and wire mills at Great Falls, Montana, and the wire mills of the **American Brass Company** at Kenosha, Wis. An offering of stock in the new company will be made for the business and assets of **Inland Wire and Cable Company,** manufacturers of a general line of bare and insulated copper wire and cable at Sycamore, Ill., on the basis of one share of stock in the new company for one share of Inland stock. In addition, stockholders of the latter company will receive a cash dividend of $4.70 a share, representing distribution of Inland's investment account. The Anaconda Wire and Cable Company will manufacture bare and insulated copper wire and cable for distribution throughout the country. Control of the company will be held by Anaconda, and the principal offices of the company will be at 25 Broadway, New York.

The new regular dividend of 75 cents for the first quarter of the year and an extra dividend of 20 cents were declared by the **Scovill Manufacturing Company** at directors' meeting last month. The company recently increased the quarterly dividend from 60 to 75 cents. Officers of the Scovill company were all re-elected at the annual meeting held last month. Net profits of $2,698,508 for 1928 are shown on the Scovill balance sheet made public last month. This amounts to $3.05 per share against $2,252,218 or $2.54 a share for 1927. In this latest statement, $4,772,870 has been transferred from the reserve item to the surplus item as compared to the 1927 report, the reserve item now being but $1,476,245 compared to $6,188,031 in the 1927 report. The surplus of $4,350,507 carried over from the 1927 report, plus the $4,772,870 transferred from reserves, plus the net profits of $2,698,508 makes a surplus before payment of dividends of $11,821,885, which less dividends paid of $2,522,250, leaves a balance for the beginning of this year of $9,299,635 or $4,949,128 more than a year ago. The item for depreciation and replacement is set down as $18,377,961 or more than $500,000 above a year ago. Total capital assets are set down at $34,505,338 compared to $33,778,698 a year ago.

Two new vice presidents and three additional directors were elected at the annual meeting of the **Beardsley and Wolcott Manufacturing Company** last month. **Charles E. Beardsley** was re-elected president and treasurer; **F. E. Wolcott** was re-elected first vice-president; and **Rowley W. Phillips** was re-elected secretary. **C. W. Schwank** was elected vice-president in charge of sales and **Robert S. Booth** vice-president in charge of manufacturing. These two new officers were connected with **Berbecker and Rowland Manufacturing Company,** recently acquired by the Beardsley company. The three new directors are: **F. D. Coster,** who is president of the **McKesson and Robbins Company,** Mr. Schwank and Mr. Booth. It was announced that as a result of the recent mergers, the company now comprises three divisions: electrical appliances marketed and advertised under the name "Torrid", house furnishings, chiefly bathroom fixtures, known for over 50 years under the name, "Wilwear"; and hardware, including cabinet, drapery and upholstery hardware.

The Scovill Manufacturing Company is now manufacturing many thousand of the new 7-cent subway tokens to be used by the Interborough Rapid Transit when and if the company is permitted by the United States Supreme court to raise the fare to this figure.

Volume of orders is slightly on the decrease due to the increase in the price of metal and fabricated products, the **Chase Brass and Copper Company** declared in a statement issued last month.

"Prospects in our business are excellent," the statement reads, "unless the repeated advances in the price of copper that have been occurring for some months past are going to unsettle trade to an extent that will affect the volume of our business. We are now operating in our mill products at prac-

tically full capacity on tubing and sheet, about 80 percent on rod and 70 percent on wire. We are running on the basis of nine hours and are giving generous bonuses for generous production. Our customers have been anticipating their wants slightly, owing to the advancing metal market, and the tendency is for the volume of orders to slightly decrease, we think."

Frederick S. Chase, president of the **Chase Companies, Inc.**, was in Washington, D. C., last month, conferring with representatives of the Post Office Department relative to the proposed purchase of land adjacent to the local post office for an addition. The land has been held by the Chase family for about 10 years to protect it from being seized by speculators, in the expectation that the government would wish it for an addition. The price asked is merely the original price plus carrying charges and interest.

The name **Plumbers Brass Goods Division** has been substituted for the **American Pin Company** division of the **Scovill Manufacturing Company.** This division comprises the former **American Pin Company,** acquired by Scovill about four years ago. The name **Ampico** will be retained as the trade mark of the products of the division. **The Scovill Foremen's Association** and the **Chase Foremen's Association** held a joint banquet at the Y. M. C. A. on February 2. **Richard D. Ely,** treasurer, and **Robert L. Coe,** secretary of the **Chase Companies, Inc.,** and **G. C. St. John,** assistant secretary of the **Chase Brass and Copper Company,** and **Stanley Sunderland,** of the Scovill Company, were among the speakers. —W. R. B.

Connecticut Notes

March 1, 1929.

BRIDGEPORT—The Locomobile Company plant in this city is to be reorganized. **A. S. Freed,** president of the **Paramount Cab Manufacturing Company** of New York City, has taken over the work. The manufacture of automobiles will be continued at the Locomobile plant, but the type of car has not been disclosed. It is reported that taxicabs may be made here.

The Sikorsky Aircraft Corporation, which has plans for a factory in this city, has let the contract for the steel work to the **Porcupine Company** of Fairfield.

The Wright and Corson Company of this city, manufacturers of rivets, have purchased a tract of land in Milford on which it plans to erect a factory which will employ around 75 workers. Excavation work has been started and it is expected the factory will be operating by May 1st.

E. P. Bullard, president of the **Bullard Company,** states that the call for high-speed machinery designed to eliminate manpower in manufacturing is the basic cause for the enormous business now being done by machinery builders. Never in the history of industry has there been anything approaching the output of high-speed machinery in the country this last year, he says. **The Baird Machine Company** states its business is well over normal and steadily increasing, so that the output is sold well ahead. Additional building expansion is anticipated this year.

NEW BRITAIN—E. Allen Moore has resigned as chairman of the board of directors of the **Stanley Works** and the office has been abolished. **Philip B. Stanley** has resigned as vice-president and two new vice-presidents have been chosen. They are **R. E. Pritchard,** formerly assistant treasurer, who was also made a director for the first time; and **Ernest W. Pelton,** formerly general superintendent, who now is also general manager. These changes were made at the annual meeting last month, at which the other officers were all reelected. The company added $898,680 to its surplus after dividends and all charges and after setting up a reserve for depreciation of $782,373. Earnings after preferred dividends and other charges amount to $5.41, compared with $2.89 the past year. Total assets are given as $27,314,970, reserve for contingencies, $1,385,711 and surplus, $10,388,784.

William E. Stevens, for 58 years in the employ of the **Stanley Works,** died at the age of 78 on January 24. He was in the sales department.

William Parker last month celebrated his 79th birthday and his 60th year with the **Russell and Erwin Manufacturing Company.** He is now an assistant manager of the company, having begun as a packing clerk.

A surplus of $135,348 is shown in the annual report of the **Beaton and Cadwell Manufacturing Company,** and reserves of $8,573. Current assets are listed at $207,219 and current liabilities at $8,291.

HARTFORD—Officers and directors of the **Billings and Spencer Company** were reelected at the annual meeting of the reorganized company last month. A new office, that of comptroller, was created and **C. V. Fauver** elected to it. He has been one of the company's accountants. Business conditions of the company are the best they have been in a long time. January sales were higher than a year ago and sales this month have passed that of last month, Vice-president Deute said.

Arrow Electric Company has won its suit against the **Gaynor Electric Company** of Bridgeport for infringement of patent rights. **Judge E. S. Thomas** of the district court has issued an injunction restraining the Bridgeport company from manufacturing a certain type of flush attachment plug receptacle and appointed a special master to make an accounting of damages and costs.

The Arrow-Hart and Hegeman Electric Company has let a contract to **A. E. Peaslee, Inc.,** for two-story office building and a warehouse to contain 50,000 square feet, construction to be of brick and steel.

The Pratt and Whitney Aircraft Company, with the **Wright Aeronautical Corporation,** have received a $2,200,000 contract for 350 airplane motors from the **Fokker Aircraft Corporation of America.**

Fire wiped out the lacquer department of the **Royal Typewriter Company** last month, causing a material loss of $50,000 and an undetermined production loss. It started from a spark in one of the exhaust outlets of the ovens. All departments resumed operations after three days, but damaged equipment could not be replaced for nearly a week.

A Canadian branch of the **Pratt and Whitney Aircraft Corporation** has been organized with a capitalization of $200,000. The plant of the **Charles Walmsley Company** at Longueuil will be utilized. The directorate of the new company includes the following Hartford men and the officers of the local company: President, F. B. Rentschler; Secretary-treasurer, Charles W. Deeds, S. A. McClennan and J. F. McCarthy.

BRISTOL—The New Departure Manufacturing Company is planning additions to its plants here, in Hartford and in Meriden. A five-story addition containing 232,000 square feet of floor space will be built here and a four-story addition with 38,000 square feet will be built in Meriden. A new forge plant here is now nearly completed, which will mean the employment of 100 additional men.

The E. Ingraham Company will employ about 200 additional men upon the completion of its five-story addition about July 1. It now employs about 1,600 persons.

The Wallace Barnes Company has purchased the **Cook Spring Company** of Ann Arbor, Mich., **Fuller F. Barnes,** president of the company, announces.

The Bristol Brass Corporation earned more than $7 a share on its 60,000 common shares of $25 par value during 1928, after paying dividends on preferred and other charges according to its annual report submitted last month. Production surpassed the former peak year during the war by 2,000,000 pounds, the total for 1928 being 28,000,000 pounds. This was effected with one-third less the working force the company had during the war. To date in 1929, business booked totals 9,000,000 in six weeks and the plant is 90 days behind in production. The company increased its surplus during 1928 to $625,842, a gain of $261,532, despite payment of preferred dividends, the setting up of a new sinking fund for preferred amounting to $30,000 and making liberal charges for depreciation and reserves. Total assets increased from $2,847,164 to $3,129,531. Officers of the company were reelected at the annual meeting last month. Second vice-president, **Townsend G. Treadway** and assistant treasurer, **Carl A. Gustafson,** are new officers. The directors were all reelected.

The American Silver Company increased its surplus during

1928 by $45,000 after all charges, according to its annual report submitted last month. The officers were reelected at the annual meeting last month.

KENSINGTON—The George E. Prentice Manufacturing Company is erecting a factory addition with 25,000 square feet of floor space, practically doubling the size of the present factory. The company makes buckles, equipment for fishing tackle, garter trimmings, patent slide fasteners, key holders and key rings.

MIDDLETOWN—Russell Manufacturing Company has brought suit in the United States District Court against **J. and M. Kaplan** of New York, asking for an injunction and alleging an infringement on one of its patents. Manufacturing operations at the Russell company's new plant at St. Johns, Quebec, will begin this month. The company's plant here is operating at capacity production and **President T. McDonough Russell** predicts earnings will show an improvement over 1928 in which $18 a share was earned.

MERIDEN—Directors of the **International Silver Company** have declared an extra dividend of $2 a share on the common stock, also the regular dividend, both payable March 1 to stockholders of record February 15.

THOMASTON—The Seth Thomas Clock Company has presented a bill in the legislature to amend its charter increasing its authorized capital from $800,000 to $1,800,000. Officials state no immediate action regarding the increase is contemplated.

NAUGATUCK—Officers and directors of the Eastern Malleable Iron Co. were reelected last month.

BANTAM—The recently announced change in stock ownership of the **Trumbull-Vanderpoel Company** will not result in a change of management or removal of the plant from this town, **John H. Lancaster,** treasurer and general manager of the company, states. The company manufactures electrical appliances.

—W. R. B.

Providence, R. I.

MARCH 1, 1929.

The passage of two months of 1929 verifies the prophesies made at the beginning of the year that there would be a continuance of prosperous business activity. January returns showed that all lines of metal trades were slightly above normalcy and those for February indicate a trifle better percentage of improvement. The open winter to date has favored building operations so that the building trades have experienced unusual activity. The weather conditions have also favored the motorists which has contributed to the activities of the small tool workers. The various branches of the jewelry industry have pepped up so that all in all a new month dawns upon very roseate conditions.

Stock of the **Nicholson File Company,** now consisting of 100,000 shares of a par value of $100, will be redeemed at the rate of six shares of no par value for each of the present shares, it was unanimously voted by the stockholders of the company at their annual meeting on Feb. 13. The change, advocated for some time by the officers of the company, will make transactions in stock more convenient.

The Manufacturers' Supply Company, 72 Elm street, Providence, is owned and conducted by **Antacky Berberian,** according to his statement filed at City Hall.

The Block Jewelry Company, manufacturers of jewelry at 45 Richmond street, Providence, is conducted by **Monroe Block** and **William A. Shawcross.**

A group of 150 apprentices and officials of the **Browne and Sharpe Manufacturing Company** were present at the second annual dinner meeting of **B. & S. Apprentices' Association** held at the Port Arthur Restaurant, Providence, on the evening of Feb. 7.

A charter has been granted under the laws of Rhode Island to **Whitney and Kahn Inc.,** of Providence to deal in gold, silver and jewelry with an authorized capitalization of 100 shares of common stock without par value. The incorporators are as follows: William H. Whitney, Nathan Kahn and Harry Goldshine.

Samuel M. Nicholson was re-elected president of the **American Screw Company** at the annual meeting of the stockholders of the corporation on February 12.

The S. and S. Machine Die Casting Company is preparing to remove from 115 Point street, this city, to West Arlington in Cranston, where a factory building has been taken over and is being fitted up for the concern's purposes.

Patton-Macguyer Company are making extensive additions, alterations and improvements at its manufacturing jewelry plant at Virginia avenue and Baker street, that will cost upwards of $75,000 to $100,000. A one-story brick addition, 160 feet in length and 80 feet wide has been contracted for and there are to be a new storage building and two garages, each for two cars.—W. H. M.

Middle Atlantic States

Newark, N. J.

MARCH 1, 1929.

A portion of the plant of the **Clark Thread Company** at Central and Passaic Avenues has been leased by the **Allen Manufacturing Company,** manufacturers of radio tubes. The business was incorporated in 1925 and operations were started at Harrison, N. J. The company then turned out about 200 tubes daily; in 1926 additional equipment was installed, boosting the production to 800 tubes. Sales increased so rapidly that the company found it necessary to re-equip its entire plant with more modern and efficient machinery. The business in 1928 was six times as great as that of 1927. The present quarters have now become inadequate. The Allen Company plans new quarters to run its production up to about 12,000 tubes a day. **Henry Lange** is president; **Paul M. Connors,** vice president and sales manager; **Henry P. Lange,** secretary, and **Albert Habermann,** treasurer. The Allen company has ordered much new equipment.

The **Star Machine and Novelty Company,** of Bloomfield, have completed a new manufacturing building at Hillside. The plant is 35 feet wide and 340 feet long. The Star company manufactures a complete line of radio and phonograph hardware. The company is installing new equipment.

The members of the **American Institute of Mining and Metallurgical Engineers,** including the large representation of the Institute in Middlesex, Monmouth and Ocean Counties, were guests recently at West Point. The visit of the Institute to West Point was brought about through Representative Harold G. Hoffman, of South Amboy.

Newark concerns incorporated recently are as follows: **Bestmade Products Corporation,** $50,000, mechanical devices. **H. M. Kent Company,** 200 shares no par, manufacture jewelry. **Day Chemical Company,** $100,000, chemicals. **Argon Tube Corporation,** $25,000, manufacture radio parts. **E. J. Brooks Company,** $200,000, metal goods. **Armour Chemical Company,** 1,000 shares no par, chemicals. **Woodruff Patents, Inc.,** 2,500 shares, lubricating devices. **Automatic Safety Control,** $100,000, braking devices. **Baldwin Silver Company,** 100 shares, manufacture silverware. **Phoenix Brass Fittings Corporation,** $500,000 preferred and 1,000,000 shares common, to manufacture brass fittings.

—C. A. L.

Trenton, N. J.

MARCH 1, 1929.

W. P. Bowman, representing the **John A. Roebling's Sons Company,** went to Washington, D. C., recently and told the Ways and Means Committee of the House of Representatives that the high costs since 1922 on wire rope necessitated an increase in the tariff on this important steel product of from 35 to 50 per cent. Mr. Bowman also asked for an increase of from 25 to 35 per cent on wire, but declared that he did not see need for a higher duty on insulated wire. Mr. Bowman

is treasurer of the John A. Roebling's Sons Company of New York. He said that the Roebling company operated plants at Trenton and Roebling, N. J., employing from 5,500 to 6,500 hands. He said that the alarming growth of imports of its commodities (wire rope, wire and strand) since 1922 and their sale in United States markets at prices which cannot be met by our domestic concerns, constitutes an emergency in the industry that can be met only by an increase of tariff protection. He declared that it cannot be met by cheapening the product without endangering life and property. He said 80 per cent of the manufacturers of wire rope are in support of the plea of the Roebling company for an increase in the duty of this highly essential product; that the demand and uses for this rope are on the constant upward trend. At the same time, he said, the price has been affected by foreign competition. The cost of the metallic content of wire, wire rope and strand represents only a small percentage of the total cost.

Bert Acosta, famous trans-Atlantic flier, will start the manufacture of airplanes at the former plant of the **Mercer Automobile Company** at Trenton. The Acosta plant will occupy a part of the same building used by the **Roller Bearing Company of America.** The new concern will have about 50,000 square feet of floor space, with sufficient acreage for expansion and room also for an experimental landing. About 100 persons will be employed at the plant. All the metal parts of the planes will be manufactured at the Trenton plant.

The following concerns were chartered in Trenton: **Consolidated Vacuum Tube Corporation,** Hoboken, 2,000 shares no par, manufacture radio tubes. **Art Metal Guild,** Passaic, $100,000, manufacture brass. **Mills Sheet Metal Works,** Union City, $100,000, manufacture sheet metal products. **Remuva Company,** Camden, $50,000, chemical products. **Sanite Corporation,** Burlington, $100,000, chemical products. **Felco Manufacturing Company,** East Orange, 10,000 shares no par, manufacture containers. **Hudson Detergents Corporation,** Jersey City, $100,000, chemicals. **New Jersey Chemical Products Company, Inc.,** Jersey City, $10,000, manufacture chemicals.

C. A. L.

Middle Western States

Detroit, Mich.

March 1, 1929.

The Detroit Lead Pipe Works, manufacturers of plumbing equipment, it is announced, recently purchased a two-acre site at Livernois avenue and the Detroit Terminal railroad. Greatly increased manufacturing facilities will be made available in the new plant, it is stated, the cornerstone for which is expected to be laid some time in March. Rail sidings and increased yardage also will add to the efficiency and rapid handling of local and outside shipping.

The Baldwin Abrasives, 366 South boulevard, is the name of a new concern recently incorporated at Pontiac, Mich. Its capital stock is $10,000. The owners are Samuel C. Clark and Otto B. Sachse, Pontiac; Russell H. Baldwin, Birmingham, Mich.

The Wolverine Enameling Company reports orders on hand and prospects for new business about equal to those of a year ago. It is optimistic regarding business for practically the entire year.

The Warner Aircraft Corporation, manufacturers, has recently purchased a six-acre factory site near the Seven Mile road and the Grand Trunk railroad and has started construction of a $150,000 plant. **Edwin N. Leftwich,** vice president, says the new plant was made necessary in order to increase production and keep pace with the rapidly growing industry. The building now under construction will be the first unit of a much larger plant, it is stated.

The John W. Brown Manufacturing Company, producers of automobile lamps, reports net earnings of $577,910 during 1928, as compared with $180,085 for 1927.

Reports recently presented to stockholders of the **Mueller Brass Company,** of Port Huron, showed that sales of the organization during 1928 totaled $6,666,000, an increase of more than $1,000,000 over sales for the previous year. "This was the biggest year in the history of the company," announces **Fred L. Riggin,** secretary and assistant treasurer. He also says that prospects for 1929 are bright and that the company expected to exceed the record established in 1928. **Oscar B. Mueller** has been re-elected president and general manager; **Bernhardt F. Mueller,** vice president and assistant manager, to succeed **Robert Mueller** of Decatur, Ill. **R. W. Peden** was re-elected treasurer; **Fred L. Riggin,** secretary, and assistant treasurer. **Miss Zelda Dukel** has been made assistant secretary, and **D. E. Lindquist,** plant superintendent. **Burt D. Cady** has been added to the board.

The Stearns Motor Manufacturing Company at Ludington has 10 per cent more orders on hand at the present time than it had a year ago. It regards as favorable the outlook for the first half of 1929. During this period it will be in the market for brass castings and other materials.

Perhaps not every purchaser of a Hudson or Essex motor car knows that the engine pistons, the crank case, the transmission housing, and numerous small die casting about the car, are made of aluminum alloy. It is for this reason the **Hudson Motor Car Company** is one of the world's largest users of aluminum.

The Michigan Valve and Foundry Company, 3631 Parkinson avenue, Detroit, has recently been incorporated. It is engaged in a general foundry and metal manufacturing business. The incorporators are Williard F. Rockwell, Pittsburgh; Charles G. Cushing, J. Rossell Forgan, Lake Forest, Ill.

The Higgins Brass and Manufacturing Company has recently changed its name to **Higgins Brass and Manufacturing Corporation.**

H. Brewer and Company at Tecumseh, Mich., reports twice as many orders ahead at this period as it had a year ago. It furthermore finds the outlook for the first half of 1929 exceedingly favorable.

The net earnings of the **Metal Craft Corporation at** Grand Rapids for 1928 are reported as $211,307.71, after providing for taxes, depreciation and reserves, an increase of $83,510.05 over those for 1927, according to an announcement by **R. Wallace Hook,** president.

The Scott Valve Manufacturing Company, Detroit, successors to the **Roe Stevens Manufacturing Company,** announces a reorganization. Facilities will be increased for the manufacture of valves. Officers of the company are: President, Alexander P. Gow; vice president, John A. Bass; secretary, A. DeLong Thomas; treasurer, Guy C. Powell. The company was recently incorporated for $200,000.

Barnes, Raymond, Gibson, Inc., Detroit manufacturers of springs and other metal products, has purchased the **Cook Spring Company,** of Ann Arbor, which manufactures similar products. When plans are completed the Cook Company will be known as the Ann Arbor division of the Detroit organization. The Cook Spring Company was incorporated in 1924 with a capital stock of $100,000. It is headed by **A. J. Donally.** The greater portion of its products are consigned to Detroit automobile plants.

The Gale Manufacturing Company at Albion, Mich., shows a 25 per cent increase in orders over the same period of a year ago. Prospects for new business within the first and second quarters are forecast as good. During this period it will be in the market for non-ferrous scrap metals and aluminum.

The Grand Haven Brass Company at Grand Haven, Mich., now has 119 employes engaged. The outlook for future business is regarded as favorable. The company is said to be in the market for non-ferrous scrap metals.

Schedules of the **Brown Manufacturing Company** call for a record volume of business during the next several months. At the present time the company is shipping lamp requirements for the Ford, Hudson, Essex, Nash, Chrysler, Checker Cab,

Moon and Franklin Truck. Also, it is stated, that miscellaneous business is running into heavy volume.

The Kent Welding Engineers have recently incorporated at Grand Rapids. The company manufactures and deals in welding supplies and equipment. The incorporators are Harry W. Levering, Carl T. Miller and Menso R. Bolt, as trustee.

The Cadillac Air Craft Corporation, with offices at 1424 Ford Building, is a new Detroit corporation. It will manufacture and deal in aircraft, motors and accessories. Those interested in the company are William E. Metzgar, Hiram H. Walker and Arlo A. Emery.

The Abrasive Engineering Corporation is a new concern in Detroit. It has capital stock of $10,000. —F. J. H.

Toledo, Ohio

MARCH 1, 1929.

Plating and metal plants in the Toledo area are experiencing a revival in spring business, notwithstanding the fact that manufacturing conditions have been good throughout most of the winter. The plating plants, and they are numerous in Toledo, are all busy, with prospects for increased business during the first half of the year at least.

Toledo has numerous plants engaged in varied industries and many of these have plating departments. Production in such places naturally is regulated according to the demand for the articles produced, so it is seldom that some of these plants are not producing at full capacity. However, at the present time about all of them have sufficient orders ahead to keep them busy for a considerable period.

The Chromium Plating Company has recently been incorporated here. The capital is listed as 300 shares of no par value. The incorporators are Ross W. McPherson, Agnes G. Dissette and R. W. Chamberlin.

Immediate development of the additional property purchased recently by the **Electric Auto-Lite Company** at a cost of $250,000, is not contemplated, according to **C. O. Miniger,** president of the company. He indicates that the property was acquired largely in the interest of provision against future needs. For some time a portion of the property will be used for parking space. The new property gives the company practically all of the industrial space between its present plant and that of the Burt **Foundry Company,** which it also controls. —F. J. H.

Cleveland, Ohio

MARCH 1, 1929.

Production in the metal and plating industries is gradually swinging into the spring stride. Production in both of these groups has been fairly satisfactory all through the winter, but as the season gradually begins to change, business in every line is showing improvement. Cleveland, like other Great Lakes Cities, has a varied line of industries and it takes decidedly adverse conditions to cause much of a business depression here. Like other mid-west industrial centers, this area is now deep in the production of motor cars and motor car accessories. In fact, it is the activities in this particular field that are now reflected in other lines. Cleveland is facing a decidedly busy spring in metals and also plating.

The **Vulcan Aircraft Company** of Portsmouth, Ohio, makers of the "American Moth" parasol plane, has been taken over by the recently organized **Davis Aircraft Corporation** of Richmond, Ind. This concern, formerly engaged in the manufacture of the Davis automobile, will not change the "Moth" to any degree, it is stated. It will, however, continue the manufacture of the open cockpit, high wing monoplane.

The **Dayton Airplane Engine Company** at Dayton, Ohio, is prepared to go into quantity production of airplane motors, officials of the organization announce. Financing amounting to upwards of $1,000,000 has been underwritten by New York banking houses, it is stated.

H. H. Nickerson, manager of the **Hupp Motor Corporation** branch plant in this city, announces that a new expansion program will be put into effect between May 15 and June 1. Plans call for an addition of 3,500 employes to the payroll, an increase in daily production of between 350 and 400 cars. This means the purchase of $2,000,000 worth of new machinery and equipment. —F. J. H.

Chicago, Ill.

MARCH 1, 1929.

The Chicago Extruded Metals Company has purchased a tract of land consisting of approximately 152,000 square feet, located at the southeast corner of Sixteenth street and Fifty-fourth avenue, directly opposite the present plant, buildings of which were recently doubled in capacity. The land was purchased to provide for additional plant expansion.

H. A. Bernhardt and Company has been incorporated and capitalized at 2,000 shares non par value. The concern manufactures and sells metal products, by H. A. and B. B. Bernhardt, C. O. Bedell, Frederick F. Carothers.

The Greenview Manufacturing Company has been incorporated with a capital of $50,000 for the purpose of manufacturing and selling metal and other stampings, by F. J. Scott, Bertha and H. A. Siemund, and Stella Scott.

The Ehrich Marcus Company has been incorporated at Chicago with a capital of $10,000 for the purpose of manufacturing and dealing in metal lamps and furniture, by J. B. Ehrich Alfred Marcus and Goldie Ehrich.

The South Shore Sheet Metal Works has been incorporated in Chicago with a capital of $10,000 for the purpose of engaging in sheet metal work, by J. F. Browne, W. E. Dyke and John Lane.—A. P. N.

Correction:—Our previous Chicago correspondence contained an item stating that the **Dallas Brass and Copper Company** had changed its name. The information was incorrect, the proper statement being that this company will continue to operate under its original name, Dallas Brass and Copper Company, but will henceforth be known also as a **Division of Republic Brass Corporation.** —A. P. N.

Wisconsin Notes

MARCH 1, 1929.

The Fred Pabst Company, Milwaukee, owned by the **Pabst Corporation,** manufacturers of galvanized black brass nipples, has been sold to a new firm organized by **Frank Wiedeman,** former general manager of the **Pabst Corporation.** The **Wiedeman Company** has incorporated with a capital stock of $150,000 and 1,000 shares of no par value stock. **Frederick Pabst, Jr.,** formerly president of the Pabst Company, will remain with the Pabst Corporation.

The Aluminum Goods Manufacturing Company, Manitowoc, Wis., owners of the **Manitowoc Plating Works,** are planning the erection of a large addition to the present plating works. The proposed addition will be 100x170 feet, three stories high and of brick and steel construction.

Clark S. Judd, vice-president of the Kenosha plant of the **American Brass Company,** has been named vice-president in charge of the manufacturing operations of all plants of the company with headquarters in Waterbury, Conn. Mr. Judd came to Kenosha in 1910 from the Torrington plant of the **American Brass Company,** and under his direction the plant at Kenosha has expanded considerably during the past eighteen years.

Enrollment at the third annual foundry conference at Madison, Wis., February 5 to 8, under the auspices of the Department of Mining and Metallurgy at the University of Wisconsin, was double that of last year. Among the speakers at the course were **D. W. Mead,** professor of hydraulic and sanitary engineering at the university; **J. H. Mathews,** director of the course of chemistry at the university; and **S. T. Johnston,** president of the American Foundrymen's Association.—A. P. N.

The Milwaukee Branch of the American Electroplaters' Society will hold its annual session and banquet on April 6, 1929. Details of this event will be found on page 144 of this issue.

Other Countries

Birmingham, England

February 18, 1929.

The annual general meeting and coming of age celebrations of the **Institute of Metals,** of which Dr. Rosenhain is President, will be held in London on March 13 and 14. The coming of age celebrations will be marked by a conversazione to be held in the new Science Museum, South Kensington, in connection with which a metallurgical exhibition is being arranged. The Institute, founded in 1908, now has over 2,000 members to be found in all parts of the world. About 15 papers will be presented and discussed and a dinner will be held at which the speakers will include Lord Melchett, Sir Samuel Hoare and others.

The Thomas Turner gold medal has been awarded to **Professor H. C. H. Carpenter,** a Fellow of the Royal Society, Professor of Metallurgy in the Royal School of Mines, and a Senator of London University. The Thomas Turner prize trust, under which the medal is awarded, was founded to commemorate the work of Professor Turner, the first lecturer and professor of metallurgy at the Birmingham University. The medal is awarded as occasion arises to a post-graduate student of Birmingham University, or as a mark of appreciation to a person of special attainments in metallurgy, or an investigator or inventor who has shown special merit in metallurgy or metallurgical research. The previous recipients have been Sir Robert Hadfield in 1923, and Sir Gerard Muntz in 1926.

At the London section of the **British Industries Fair,** held at the White City from February 18 to March 1, the space allotted for jewelry, silver plate and cutlery was 17,500 square feet, an increase of about 3,000 square feet over last year. Birmingham jewelers had a composite exhibit in which more that 100 firms participated and in addition 20 or 30 had separate stands.

The records of the American Consul in Birmingham, H. Campbell, show that traders in this area exported more goods to the United States last year than in 1927, notwithstanding a decline in the fourth quarter. The total value was $8,533,407 for 1928 as against $7,738,233 for 1927. Plated ware and silver were exported to the value of $343,160, brass $227,087, and other metal manufactures $313,502.

The industry of chrominum plating which has been undertaken by several firms in the Birmingham district is doing its best to convince the public of the value and durability of this new finish as applied to motor car parts, household utensils, lavatory fittings, etc. The public, however, is a little shy, owing to the heavy initial cost, and only slow progress is being made in the industry.

The gradual rise in copper prices has brought increases in brass and copper tubes, and the **Brassfounders' Employers' Association** of Birmingham and the **Northern Brassfounders' Association** have found it necessary to advance their prices by 5 per cent as of January 17. The articles affected by the advance are gas, water and steam fittings. The last increase was made in February, 1925, and manufacturers feel that the present revision was long overdue.

Activity at British shipyards is gradually increasing and Birmingham brassfounders, who usually supply a good deal of the fittings for ships, expect to get their share of this business when it comes to be given out. Plumbers' brassfoundry is experiencing a satisfactory period, although in the home trade the completion of municipal housing schemes has tended to reduce the demand. Both in South America and Australia, where factories have been started, Birmingham makers find it increasingly difficult to compete.—J. A. H.

Business Items—Verified

Day Name Plates, Ltd., 4 Woodfield Road, Toronto, Can., plans construction of a factory to cost $35,000. Work will not be started until the spring or summer.

Freas-Therms Electric Company, Irvington, N. J., is building an addition 90 by 100 feet, one-story, to cost over $50,000 with equipment. Company manufactures electrical equipment.

Watson-Stillman Company, 75 West Street, New York City, manufacturing hydraulic machinery, has appointed the Midvale Mining and Manufacturing Company, St. Louis, its representative in the St. Louis district.

Hamilton-Beach Manufacturing Company, Racine, Wis., states that reports to the effect that it plans construction of additional manufacturing units are erroneous and that no new construction is planned at this time.

Canadian Hansen and VanWinkle Company, Ltd., Morrow Avenue, Toronto, Can., manufacturing foundry equipment, etc., is building an addition to cost $10,000, to provide additional manufacturing space for lacquers and enamels.

James Graham Company, New Haven, Conn., specializing in brass, bronze, composition, nickel silver, gun metal and copper foundry work and also in all grades of babbitt metal and lead castings, has acquired additional land for expansion.

Monarch Aluminum Ware Company, Payne Avenue, Cleveland, Ohio, has taken 100,000 sq. ft. of floor space in the Power Warehousing Terminal Building, where it will manufacture permanent mold and sand castings. Polishing and assembly departments will also be installed.

Gesswein Boat Corporation, Bergen Beach, Brooklyn, N. Y., has taken over the plant of the **Paul S. Gesswein Boat Company** and will manufacture inboard and outboard motor boats. It will be in the market for brass fastenings, deck fittings, etc. **Robert M. French** is treasurer and general manager.

A. D. Joslin Company, Manistee, Mich., is planning an addition to its metal goods manufacturing plant, to cost about $20,000 with equipment. Company operates brass machine shop, tool room, stamping, zincing, plating, polishing and grinding departments, lacquering and japanning rooms.

The Brown Instrument Company, Philadelphia, Pa., announces that its Buffalo, N. Y., office is now located at 402 Marine Trust Building, having recently removed from 624 Ellicott Square. This company's Cleveland office is now in charge of **O. B. Wilson,** formerly of the company's home and New York sales offices.

Phoenix Brass Fittings Corporation, Irvington, N. J., has been organized and will succeed the Phoenix Brass Foundry, operating a foundry for casting brass, bronze, aluminum, as well as plating, polishing and grinding department. It is planned to enlarge and improve the plant with new installations and to add to the line of brass products.

Peerless Roll Leaf Company, 345 West 40th Street, New York City, manufacturer of metal leaf products, has acquired the factory formerly used by the Reiss Pipe Company, Union City, N. J., to which it will remove about June 1, 1929. Additional equipment will be installed when the present works has been moved over. The company smelts, refines and rolls metals.

Dudlo Manufacturing Company, Fort Wayne, Ind., a division of the **General Cable Corporation,** has erected and is installing machinery in a one-story addition, 175 by 193 feet in area, which cost about $80,000 with equipment. This company is now erecting a new office building of three stories which will cost about $160,000 and will be completed about July 1. The company manufactures wire and cable of various types, coils, etc.

James Clark, Jr., Company, of Louisville, Ky., has been sold to the Lake States General Electric Supply Company. The Clark concern was in the electrical supply business. The **James Clark, Jr., Electric Company,** of the same place, is still in the manufacturing business, producing "Clark" electric drills, grinders, hacksaws and other electric tools. **James Clark, Jr.,** who founded both companies, states that he will devote his entire time to the manufacturing firm, now that the supply company has been disposed of.

Review of the Wrought Metal Business

By J. J. WHITEHEAD
President, Whitehead Metal Products Company of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

MARCH 1, 1929.

Prices on fabricated brass and copper materials continued to advance rapidly during the past month, following closely the rising quotations for ingot copper, and at this writing are at the highest levels since the war. There are those who say that the present level of prices is unnatural and unnecessary, basing their opinion on the belief that consumers and fabricators have created a corner in copper and are bidding up prices against themselves. Whether there is any element of truth in this idea or not, the fact is that manufacturers of brass and copper sheet rods, tubes and wire are all in the position of being unable to meet the demand for their products, and consumers are clamoring for deliveries which they find it difficult if not impossible to obtain. Practically every industry consuming non-ferrous metals is running at an unprecedented rate, consuming material in quantities out of all proportion to the amounts normally taken. Something may be learned by considering the position of nickel in relation to copper. In the nickel industry there has not been any change in price for over a year. No forward buying can be attributed to speculation or covering for price position. Nevertheless there is no stock of nickel available and deliveries are very slow. All available refinery capacity is running full, new production units are being used as fast as they can be built, and demand is still in excess of supply with no relief in sight until the middle of the year when still further new refining and smelting units will be available. Producers of nickel have not taken advantage of this situation to increase prices and there is only the widespread use of the metal to look to for an explanation of the tremendous demand.

Several months ago it was indicated that the public demand for copper for use in homes and larger buildings in greatly diversified form was keeping a steady flow of orders rolling into the mills, and the statement was then made that if the old line consumers of metal ran into a period of heavy demand the supply would be insufficient. This has actually come to pass and the present market conditions is the result. It is felt that no change will be stressed until at least the middle of the year and that if other business conditions remain the same, no change may be expected until new mills now being built are completed and in production.

There is no question that the public has become conscious of the tremendous losses due to corrosion and have been educated to call for those materials which will resist corrosion.

This has been clearly shown by the growth of the Monel metal business which is going forward so rapidly that there is talk of building new mills in anticipation of the expected needs for Monel metal and fabricated nickel.

All of this prosperity in the non-ferrous metal business is, of course, dependent on the condition of general business and the fact that the man in the street is educated to insist on the best and has the money to pay for it. Most of the modern luxuries and necessities such as radio, automobiles, washing machines and similar articles are dependent for their operation on brass, copper, nickel and Monel metals, all of which have rightfully earned the title of the "Quality Metals of Industry." Without them no progress would be possible in scientific or mechanical lines, and while progress continues and they are required in increasing volume the business must remain prosperous.

Metal Market Review

By R. J. HOUSTON
D. Houston and Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

MARCH 1, 1929.

COPPER

The market for copper was definitely on the upward trend in February, and developments gave a broad and continuous demonstration of the extraordinary strength of this metal. Prices advanced ¾c per pound during the first seven days of the month, namely from 17¼c to 18c delivered to Connecticut Valley points. Following three successive advances steady conditions prevailed for a full fortnight during which time the volume of new business for domestic and export account was heavy. The buying movement during this period, however, was conducted so quietly, and in such a matter of fact manner, that it escaped much public attention.

A new development of strength appeared at the month-end. There was a vigorous forward movement in the market, and the domestic price was advanced to 19¼ cents. This sent quotations into record high ground since June, 1920. Buying interest gained in momentum as market firmness persisted, and consumers were alert to cover requirements over several months. The situation from a statistical angle is highly favorable to market strength. It is also a conspicuous coincident that consumers as well as producers are reaping the benefits of better selling prices and profits. Buying for export was a noteworthy feature, and the price for shipment abroad at close of month was 19¾ cents c. i. f. European ports with prospect of further advances shortly. The market has been gaining headway every day lately. Consumers at home and abroad were feverishly eager to cover requirements as far ahead as producers were inclined to sell. Big electrical and other projects have loomed up and clearly indicate what may be expected in the way of demand for years to come. Present huge requirements are by no means a flash in the pan, but they are the logical outcome of the tremendous developments now under way. Copper was at subnormal market values for years. Today we are faced with new conditions, and the consuming world recognizes copper as an ultra important commodity in carrying out the progressive plans which have been undertaken with rapidly increasing determination.

ZINC

The action of the market for zinc recently showed virtually but little price change. There has been somewhat stubborn resistance to any downward tendency lately, and the advance of $1.00 per ton in zinc ore to $41 probably had the effect of giving steadiness to the price situation. Demand, however, was only moderate in February. More urgent needs should develop as brass manufacturers and galvanizers are using up a large tonnage of zinc in their operations. Prime Western slab zinc has sold at 6.32½c and 6.35c East St. Louis. The New York basis quotes 6.67½c to 6.70c. Surplus stocks of slab metal showed little change in January. The tonnage in smelters' hands on Ferbuary 1 amounted to 45,418 tons, being a decrease of 23 tons compared with the figures on January 1. Stocks on February 1, 1928, were 42,163 tons.

TIN

Conditions in the tin market were quite firm early in the month, with Straits for future delivery selling at 50⅛c. This price proved to have been the highest in February. Irregular tendencies characterized subsequent movements, and periods of dullness and weakness were rather frequently noted. Consumers were buyers on a moderate scale, but local activity was not pronounced enough to give the market much effective support. American tin deliveries recently have been heavy. During the last six months, ended January 31, they amounted to 43,655 tons compared with 38,590 tons for the previous six months. Despite the large quantities taken by the domestic trade the market declined 1½ cents per pound since February 5. There was considerable activity during the last half of month, with fair consuming interest displayed. Straits tin for March delivery was quoted at 48⅞ cents, with 49 cents for later delivery.

ALUMINUM

Demand for aluminum continues in large volume, and there seems little doubt that consumption will remain on a very high basis. The automotive industry creates a big outlet, and consumption by the electrical and aeroplane industries is on the increase. Price of Alcoa 99% plus is 24.30c and that of 94% plus 22.30c. Imports of aluminum into the United States in 1928 totaled only 37,895,832 pounds compared with 72,188,518 pounds in 1927, a decrease of 34,292,686 pounds. The bulk of imports in 1928 or 23,163,600 pounds came from Canada, leaving but 14,732,232 pounds arriving from the European producers. Canada exported a total of 40,597,100 pounds of aluminum to all countries in 1928 as against 51,902,400 pounds in 1927, being a decrease of 11,305,300 pounds. Japan, United Kingdom, Italy and Belgium took large quantities of the Canadian product.

ANTIMONY

Restricted consuming demand and receding prices were features in the antimony market during February. The month opened fairly firm at 9⅝c for regulus antimony, duty paid. Around the end of the month the situation became easier and the price level was down to 9¼c duty paid for both prompt and future positions. Chinese quotations at close were equal to 7¼c c. i. f. New York. There were no outstanding developments to indicate any immediate change of pronounced character. It is reported that certain parties are seeking to have the present duty of 2 cents per pound raised to 4 cents per pound. If successful this tax would oblige the consumer to pay more for the metal as this country has to depend on imported material for its supply of antimony. The trade should be alive to this movement for its own interests. Bonded stocks of antimony in warehouses here on February 1 amounted to 3,020,053 pounds, as against 2,952,267 pounds on January 1, 1929.

LEAD

Demand for lead has been very heavy lately, and the market is now in a better position than it has been in for nearly two years. The New York price at present is 7.10c against 6.65c at the beginning of the year. Consumption is on a high scale, and those who have followed these reports in recent months could not fail to understand that the market was headed for a general upward revision. There was persistent buying of nearby and future deliveries. Practically all lines of consuming industries have been covering requirements over next several weeks. Trading was consequently unusually brisk and producers are well booked up with orders for March and April. There was some inquiry for May shipment, but producers are not disposed to extend deliveries so far ahead on current price rates. World output of lead in January was 156,679 tons, against 163,205 tons in December and 150,641 tons in January, 1928. Producers in the Middle West quote 7c to 7.05c East St. Louis basis. It would not be surprising to see the price move up to a higher level.

QUICKSILVER

A firmer condition prevails in quicksilver. There have been numerous inquiries lately at the higher prices recently established of $123 to $124 per flask. All classes of consumers show interest and demand is fair. Stocks are reported light and will need replacement.

PLATINUM

Refined platinum quotes $66.50 per ounce. Demand is of routine nature.

SILVER

The silver situation has moved along quietly for the most part in recent weeks. Prices keep within narrow limits, and there were no broad movements pointing to decided betterment. India was in the market to a moderate extent at the recent low dip when price fell to 55⅝ cents. China also showed some interest which caused a slight rally to 56c. The undertone was fairly steady for a time, but the market is devoid of any really bracing factors. March 1 quotation for bar silver was 56¼c. Silver stocks in Shanghai recently were 150,000,000 taels. Total number of Chinese silver dollars amounted to 111,100,000.

OLD METALS

The movement in copper and brass scrap material naturally reflects the extraordinary condition prevailing in the market for new copper. There is considerable uncertainty in this branch of the trade and buyers show some hesitation in meeting the higher range of values. Available supplies are not extra large, and holders are in position to maintain a firm attitude. Lead grades are also firm owing to the advance in pig lead. Buyers are rather eager to secure material even at the higher prices. New York dealers quote buying prices as 16¼c to 16½c for crucible copper, 13¾c to 14c for light copper, 9¼c to 9½c for heavy brass, 12¼c to 12½c for new brass clippings, 5⅜c to 5½c for heavy lead, and 16¾c to 17c for aluminum clippings.

Daily Metal Prices for the Month of February, 1929

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	4	5	6	7	8	11	12*	13	14	15	18
Copper c/lb. Duty Free												
Lake (Delivered)	17.375	17.375	17.625	17.875	18.125	18.125	18.125	....	18.125	18.125	18.125	18.125
Electrolytic (f. a. s. N. Y.)	17.25	17.25	17.50	17.75	18.00	18.00	18.00	....	18.00	18.00	18.00	18.00
Casting (f. o. b. N. Y.)	17.00	17.00	17.25	17.50	17.75	17.75	17.75	....	17.75	17.75	17.75	17.75
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	6.35	6.35	6.35	6.35	6.35	6.35	6.35	....	6.35	6.35	6.35	6.35
Brass Special	6.45	6.45	6.45	6.45	6.45	6.45	6.45	....	6.45	6.45	6.45	6.45
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	48.75	49.375	50.375	50.125	49.625	49.625	49.625	....	49.625	49.75	49.75	49.125
Pig 99%	47.75	48.50	49.50	49.25	48.50	48.50	48.50	....	48.625	48.75	48.75	48.125
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	6.50	6.525	6.50	6.625	6.625	6.65	6.75	....	6.75	6.75	6.75	6.75
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	....	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	35	35	35	....	35	35	35	35
Shot	36	36	36	36	36	36	36	....	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	....	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	9.625	9.625	9.625	9.625	9.625	9.625	9.60	....	9.60	9.60	9.50	9.50
Silver c/oz. Troy Duty Free	56.75	56.75	56.50	56.625	56.375	56.875	56.125	....	56	56	55.875	55.75
Platinum $/oz. Troy Duty Free	66.50	66.50	66.50	66.50	66.50	66.50	66.50	....	66.50	66.50	66.50	66.50

	19	20	21	22*	25	26	27	28	High	Low	Aver.
Copper c/lb. Duty Free											
Lake (Delivered)	18.125	18.125	18.125	....	18.375	18.625	19.125	19.625	19.625	17.375	18.181
Electrolytic (f. a. s. N. Y.)	18.00	18.00	18.00	....	18.25	18.50	19.00	19.50	19.50	17.25	18.056
Casting (f. o. b. N. Y.)	17.75	17.75	17.75	....	18.00	18.25	18.75	19.25	19.25	17.00	17.806
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb											
Prime Western	6.35	6.35	6.35	....	6.35	6.35	6.35	6.35	6.35	6.35	6.35
Brass Special	6.45	6.45	6.45	....	6.45	6.45	6.45	6.45	6.45	6.45	6.45
Tin (f. o. b. N. Y.) c/lb. Duty Free											
Straits	49.25	49.10	49.00	....	49.00	48.875	48.875	48.80	50.375	48.75	49.169
Pig 99%	48.25	48.125	48.10	....	48.10	48.00	48	47.90	49.50	47.75	48.401
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	6.85	6.85	6.85	....	6.90	6.90	7.00	7.05	7.05	6.50	6.754
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	....	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb.											
Ingot	35	35	35	....	35	35	35	35	35	35	35
Shot	36	36	36	....	36	36	36	36	36	36	36
Electrolytic	35	35	35	....	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	9.50	9.50	9.375	....	9.35	9.30	9.25	9.25	9.625	9.25	9.501
Silver c/oz. Troy Duty Free	56	55.875	55.875	....	56.25	56.375	56.25	56.50	56.875	55.75	56.264
Platinum $/oz. Troy Duty Free	66.50	66.50	66.50	....	66.50	66.50	66.50	66.50	66.50	66.50	66.50

* Holiday.

Metal Prices, March 11, 1929

NEW METALS

Copper: Lake, 19.625. Electrolytic, 19.50. Casting, 19.25.
Zinc: Prime Western, 6.35. Brass Special, 6.45.
Tin: Straits, 48.75. Pig, 99%, 47.80.
Lead: 7.25. **Aluminum,** 24.30. **Antimony,** 9.375.

Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $123. **Bismuth,** $1.70.
Cadmium, 95. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 56.25.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $66.50.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	13¾to15
Brass Ingots, Red	17½to19½
Bronze Ingots	18½to25
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	26 to40
Manganese Bronze Ingots	16 to18
Manganese Bronze Forging	34 to42
Manganese Copper, 30%	25 to35
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	18½to21
Phospo Copper, guaranteed 15%	23 to26
Phospo Copper, guaranteed 10%	22 to25
Phosphor Tin, no guarantee	60 to70
Silicon Copper, 10%, according to quantity	28 to32

OLD METALS

Buying Prices		Selling Prices
15½to16	Heavy Cut Copper	16½to17
15 to15¼	Copper Wire, mixed	16 to16¼
12¾to13	Light Copper	13¾to14
10¾to12	Heavy Machine Composition	11¾to13
8¾to 9	Heavy Brass	9¾to10
7¼to 7½	Light Brass	8¼ to8½
10¼to10½	No. 1 Yellow Brass Turnings	11¼to11½
10¾to11	No. 1 Composition Turnings	11¾to12
5½to 5¾	Heavy Lead	6¾to 7
3½to 3¾	Zinc Scrap	4¾to 5¼
8 to10	Scrap Aluminum Turnings	12½to14¼
13 to13½	Scrap Aluminum, cast alloyed	17½to18½
19 to20	Scrap Aluminum sheet (new)	22 to22½
30½to32	No. 1 Pewter	35 to38
20 to21	Old Nickel Anodes	22 to23
20 to23	Old Nickel	22 to25

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled)	29⅛c. to 30⅛c. net base
From Stock	30⅛c. to 31⅛c. net base

BARE COPPER WIRE

21⅛c. to 21½c. net base, in carload lots.

COPPER SEAMLESS TUBING

30⅝c. to 31⅛c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	27⅝c. net base
100 lbs. to 200 lbs. in one order	28⅝c. net base

ZINC SHEET

Duty sheet, 15%	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount	9.75 net base
Casks, jobbers' price	10.25 net base
Open casks, jobbers' price	10.75 to 11.25 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price, ton lots	33.30c.
Aluminum coils, 24 ga., base price, ton lots	31.00c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 57½c. to 59½c. per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect March 4, 1929
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.23¾	$0.25¼	$0.27¼
Wire	.24¼	.25¾	.27¾
Rod	.21½	.26	.28
Brazed tubing	.31¾	....	.37
Open seam tubing	.31¾	....	.35
Angles and channels	.31¾	....	.35

BRASS SEAMLESS TUBING

30⅜c. to 31⅜c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	25¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	24¾c. net base
Muntz or Yellow Rectangular sheet, other Sheathing	25¾c. net base
Muntz or Yellow Metal Rod	21¾c. net base

Above are for 100 lbs. or more in one order

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	31½c.	10% Quality	34½c.
15% Quality	33c.	15% Quality	38¼c.
18% Quality	34¼c.	18% Quality	41½c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs. 25c. over. Prices f. o. b. mill.

Supply Prices, March 11, 1929

ANODES

Copper: Cast ....
Rolled, oval ....
Rolled, sheets, trimmed....
Brass: Cast ....
} Quotations uncertain, due to rapid fluctuation of copper prices.

Zinc: Cast ....12¼c. per lb.

Nickel: 90-92% .... 45c. per lb.
95-97% .... 47c. per lb.
99% .... 49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 59¼c. to 61¼c., Troy ounce, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	\$3.00/lb.	\$2.75/lb.	\$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	\$29.65
14" 20 ply 64/68 Unbleached	38.20
12" 20 ply 80/92 Unbleached	32.45
14" 20 ply 80/92 Unbleached	44.00
12" 20 ply 84/92 Unbleached	42.50
14" 20 ply 84/92 Unbleached	57.60
12" 20 ply 80/84 Unbleached	38.35
14" 20 ply 80/84 Unbleached	52.00

Sewed Pieced Buffs, per lb., bleached................45-65c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.14-.19
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic, 75 and 125 lb. drums	lb.	.20½-.21
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.17¼-21¾
Denatured, drums	gal.	.48-.56
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride, solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls.	lb.	3.3
Sulhpocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.25
Chromic Sulphate	lb.	.37
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.16½-.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls.	lb.	6¼
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	\$30.00
Fluor-spar (Calcic fluoride)	ton	\$70.00
Fusel Oil	gal.	\$4.45
Gold Chloride	oz.	\$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¾
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	\$1.58
Nickel—Carbonate, dry bbls.	lb.	.35
Chloride, bbls.	lb.	.20
Salts, single, 300 lb. bbls.	lb.	.13
Salts, double, 425 lb. bbls.	lb.	.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.06¾-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	\$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.46½
Cyanide (fluctuating)	oz.	.57-.60
Nitrate, 100 ounce lots	oz.	.40
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.18
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.38
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	03¾